Nordic Council of Ministers

Quantification and environmental pollution aspects of lost fishing gear in the Nordic countries

Contents

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Summary

The occurrence of abandoned, lost, and discarded fishing gear (ALDFG) in aquatic environments contributes both to environmental and socioeconomic impacts. In nature, discarded fishing gear contributes to pollution by macro- and microplastics and harmful chemicals as well as to the degradation of habitats. This study compiles information from the Nordic countries on the quantity and composition of lost fishing gear, originating mainly from sport- and recreational fishing activities. The study also considers the occurrence of harmful chemicals associated with the lost fishing gear and the potential impact of these chemicals on the aquatic environment. Suggestions on how to prevent further losses and mitigate negative impact of lost fishing gear are also provided.

This study is based on several methodological approaches to obtain and compare data from different sources. We have conducted a literature survey, conducted several stakeholder dialogues, analysed information on sales statistics from retailers and producers and compiled relevant national import and export statistics. A web-based survey specifically directed towards gaining information from sports- and recreational fishers was developed, disseminated and results compiled. The data generated from the survey was used for comparison with official national statistics.

Sweden, Norway, Finland, and Denmark have national statistics on the number of sport- and recreational fishers available online. This group encompasses around 1.7 million persons in Sweden, 2 million in Norway, 0.3 million in Denmark and 1.5 million in Finland. The statistics for Iceland, Greenland and the Faroe Islands was based on a fraction of the national population. The fraction was based on a similar interest for fishing in these compared to other Nordic countries. The average number of sport- and recreational fishers was thus estimated to be around 21.5% of the population. Based on this method, the Nordic countries have about 5.6 million active sport- and recreational fishers in total. This number was multiplied by the average amount of gear lost per person and year obtained from the survey results. The estimated number of lost fishing gear in the Nordic countries thus amounts to 28 million baits, 11.2 million sinkers and 140 million metres of fishing line per year. The survey generated 449 replies of which 386 respondents were from Sweden, 49 from Denmark and the Faeroe Islands and 14 from Finland.

National statistics on imports, exports and industrial production does not specify the intended user of the specific fishing gear. However, due to the specificity in behaviours and equipment of the type of fisher, it can be assumed that some of the commodity codes are likely to correspond either to sport and recreational fishing or to commercial fishing. Based on this assumption, the project has estimated total annual losses in the Nordic countries of 774 tonnes fishhooks, 78–235 million meters fishing line and 518–1035 tonnes of fishing gear containing fishing nets. Since fishing gear made from nets mainly concerns commercial fishing, these losses are assumed mainly to originate from commercial fishing. Fishing line is mainly related to sport and recreational fishing while fishhooks were hard to assign to a specific user.

Because of the large amount of fishing gear lost at sea, their presence is likely to have negative effects on aquatic ecosystems. Plastic additives and associated chemicals constitute a plethora of harmful substances that can leach from plastic

materials. Fishing plummets made of lead are also problematic since lead is toxic. The use of lead in sinkers and plummets is fortunately already banned in both Denmark and Greenland and similar restrictions are likely to be introduced in all Nordic countries due to the possible coming proposal from the EU Commission.

The most common types of plastic used in fishing gear are Polyethylene (PE), Polypropylene (PP) and Polyamide (PA or nylon). Some common additives in plastics are stabilizers, fillers, colorants, antioxidants, flame retardants and plasticizers. A mapping study analyzed 17 different kinds of fishing lures of which 15 contained phthalate and 6 out of 17 lures contained the phthalate DEPH which is banned from use in the EU. Even if harmful substances do exist in fishing gear it has not, within the framework of this study, been possible to quantify the annual amount released to the environment. The necessary information on additives and chemicals present in fishing gear has not reported or has never been analysed. Producers and resellers of fishing gear, contacted in this study could not or were unwilling to share information about the chemical contents of their products even though REACH stipulates that supplier should provide information about SVHC (substances of high concern) in their products within 45 days.

We suggest the following measures to reduce the occurrence and impacts of lost fishing gear; 1) municipalities and retailers should provide information on the topic to increase the awareness among fishers, 2) incitements to reuse, recycle or recover should be improved, 3) better information chemical substances present in fishing gear, 4) ban of harmful substances including lead in fishing gear and 5) conduct clean ups of hotspots which also will contribute to reduce new losses. Implementation of the EU Single-Use Plastics Directive and upcoming extended producer responsibility including fishing gear in the Nordic countries are important drivers supporting this positive development.

The quantity and composition of lost fishing gear are difficult to estimate mainly due to the general lack of data within this area. In this study, estimations of lost gear such as fishing line, baits and sinkers were calculated. It is, however, important to recognise that estimates of lost fishing gear in the Nordic countries are rough and based on many assumptions, combined with a low response rate on the survey. In conclusion, the estimates presented here should be considered indicative of potential losses of fishing gear in the Nordic countries. By using two different and independent methods to collect data for estimating losses of fishing gear, we have aimed to shed light on uncertainty. Furthermore, we provide all assumptions and calculations for transparency. Even though the methods to some extent give similar results, the figures are overestimated due to our conservative assumptions based on the precautionary principle and better data are needed to provide reliable decision support.

Definitions

[1]

The following definitions have been used throughout this report:

Commercial fishing: Commercial fishing often requires a license, and the catch is for selling purposes.

Recreational fishing: Fishing that has a recreational purpose where the catch is either released back to nature or used in the own household or town livestock farming. Recreational fishing does not include catch that is sold. Within the EU, it is illegal for recreational fishers to sell their catches.

Sportfishing: Sportfishing or angling is a subgroup of recreational fishing. Sport fishers mostly use hand-held fishing gear with only one hook. The catch is not sold.

Passive fishing gear: Fishing gear that does *not* need human activity during the act of fishing, and where the gear is meant to catch fish lying still in the water. This included for example, gillnets and cages (National encyclopedia, n.d.).

Active fishing gear: Fishing gear that need human activity to catch fish. For example, trawls, and sportfishing tools such as baits, and weights (National encyclopedia, n.d.).

ALDFG: Abandoned, lost or otherwise discarded fishing gear (GSAMP, 2021).

1. A definition on Recreational Angling agreed by the European Anglers Alliance at the General Assembly 2004 in Dinant, Belgium.

1 Introduction

The occurrence of abandoned, lost, and discarded fishing gear (ALDFG) in aquatic environments contributes both to environmental and socioeconomic impacts. In nature, discarded fishing gear contributes to pollution by macro- and microplastics and harmful chemicals as well as to the degradation of habitats (Gilman, 2015; Richardson et al., 2019). Aquatic wildlife also become entangled in lost equipment, often referred to as "ghost fishing". Lost fishing gear and nets also creates obstacles the societal journey towards sustainable fisheries, especially in areas with high fishing activities. Consequently, catches may be reduced, and marine litter originating from fishing activities accumulate on beaches and may in turn affect tourism and recreational values. Passive fishing gear, such as gillnets and traps have a higher risk of getting lost compared to active fishing gear, such as trawls and seines. In Norway, the loss of equipment such as cages and ropes is of increasing environmental concern (Sundt et al., 2018).

It is challenging, time consuming and expensive to clean-up and recover ALDFG. Examples of such efforts are beach clean-ups, diving campaigns and dredging for lost fishing gear. It is more cost efficient and less environmentally challenging to implement preventive measures related to the loss of fishing gear. ALDFG is a global problem and oceans have no boundaries. An extended geographical approach is therefore required in order to understand the extent of the problem and suggest fitting management actions. According to investigations preceding the establishment of the single use plastic (SUP) directive, a quarter of the marine litter originates from fishing gear (European Parliament, 2019). In addition, a transect survey carried out in the North Sea found that a large part of the marine litter originated from fishing activities in the form of gear such as nets and wires (Buhl-Mortensen & Buhl-Mortensen, 2017).

There are several projects funded by governments and non-profit organisation as well as voluntary commitments aiming to map and reduce the amount of lost or discarded fishing gear in the sea, in lakes and on beaches. As an example, the Nordic council funded project Clean Nordic Oceans established a network with the aim to "exchange knowledge and experiences of methods and measures to reduce ghost fishing and marine litter. The goal was also to promote proper disposal and recycling of commercial and recreational fishing gear. It was found that Nordic countries generally have a low level of knowledge regarding quantities and geographical distribution of lost fishing gear (Langedal et al., 2020), although some efforts have been made to estimate the amount of litter generated from lost fishing gear (Sundt et al., 2018; Skogesal & Fasting, 2022).

1.1 Aim and objectives

The aim of this study was to estimate the quantities and composition of fishing gear lost mainly from sport- and recreational fishing in the Nordic counties. In addition, the study aimed to explore the occurrence of harmful chemicals associated with the lost fishing gear and discuss the potential impact on the aquatic environment. The objective was to suggest useful measures to prevent further losses and potential impacts of chemical substances leakage from the equipment based on obtained data and information. The study has addressed SDG12- responsible consumption and production and SDG14- life below water.

1.1.1 Scope and limitations of the study

This study focuses primarily on sport- and recreational fishing and is geographically limited to the following countries: Denmark, Finland, Iceland, Norway, Sweden and the areas of Greenland, the Faroe Islands and Åland. These countries are referred to as the 'Nordic countries' in this report. Estimations of lost fishing gear is based on fishing gear sold to and used by fishers in the Nordic countries. Other losses of fishing gear in Nordic waters that have occurred as a result of fishing by, for example, foreign fishers that have bought their equipment elsewhere, are not included in this study. The study has investigated the following types of fishing gear: traps, cages, pots, fishing nets and hand-held fishing gear including lures, baits, and weights with corresponding hooks, lines, and light components (See photos of some of the fishing gear in fig. 1,2,3 and 4).

Losses from sport and recreational fishing are based on multiple methods of data collection. This includes data from published scientific studies, numerical data, stakeholder dialogues as well as a web survey disseminated to sport- and recreational fishers in the Nordic countries. Relevant data and information were collected during the project which stretched from November 2021 to June 2022. The web questionnaire was developed by IVL and published by several organisations in March-April 2022 and concluded in June 2022. Literary sources, both peer-reviewed and grey scientific literature, published in the year 2010 or later were used in this study. Literature published before this year were only used in specific cases where it was considered relevant.

The investigation on harmful materials and toxic substances in fishing gear used in the Nordic countries was limited to a literature review and a dialogue with manufacturers. Only a general mapping of commonly used harmful materials and substances are covered here.

Measures to prevent and reduce loss of fishing gear in the Nordic countries are proposed in this report. In additions, measures to reduce harmful materials and substances in fishing gear are proposed. The study is limited to measures that focuses on economic and environmental incentives developed with a specific stakeholder in mind. However, the full impact of mentioned measures and in-depth description of how these can best be implemented is beyond the scope of this study. The proposed measures should thus not be considered final but merely function as suggestions to be considered from a Nordic perspective. This study briefly touches upon legislation and implemented measures in Nordic countries covering aspects

related to the loss of fishing equipment. A study that covers existing legislation and measures in more detail is the main report from Clean Nordic Oceans (Langedal et al., 2020). The report from Clean Nordic Oceans also includes a discussion on similarities and differences between Nordic countries, including an in-depth analysis of actions in terms of their feasibility and efficiency to reduce plastic pollution from lost fishing gear.

2 Background

2.1 Applicable legislation and frameworks

There are various frameworks and international legislation connected to fishing. In this chapter, a short introduction to relevant organisations, frameworks and EU regulations are presented.

2.1.1 International framework and organisations

There is various international legal framework connected to fishing. The scope, focus and connection to fishing varies between different frameworks. According to GSAMP (2021), the following international frameworks are particularly worth mentioning in relation to marine litter:

- UNCLOS – United Nations Convention on the Law of the Sea
- International Maritime Organization
- The UN Fish Stock Agreement (UNFSA)
- The FAO Code of Conduct for responsible fisheries

In addition to international frameworks, much work is done by national authorities and by non-for-profit organisations (NGOs) as well as intergovernmental organisations. According to (GSAMP, 2021) the following frameworks are relevant:

- OSPAR – The Convention for the Protection of the Marine Environment of the North-East Atlantic
- Arctic Council
- North-East Atlantic Fisheries Commission
- European Union – through various organisations and directives
- The Baltic Marine Environment Protection Commission (HELCOM)
- The Nordic Council of Ministers

2.1.2 Council Regulation (EC) No 1224/2009

The Council regulation (EC) No 1224/2009 establishing a community control system for ensuring compliance with the rules of the common fisheries policy intends to provide strategies for a sustainable exploitation of aquatic resources. According to Article 48 - Retrieval of lost gear, a couple of measures should be taken by commercial fishing vessels regarding lost fishing gear (European Council, 2009). The measures are presented below:

1. A commercial fishing vessel is required to have suitable equipment for retrieving lost gear on board.
2. When fishing gear is lost, the captain of the vessel should take action to attempt to retrieve the gear as soon as possible.
3. If attempts to retrieve the gear are unsuccessful the captain is required to inform the relevant authorities in the Member state it belongs. The following should be reported; the identification number of the vessel, the name of the

vessel, the type of gear, the time of loss, the position of loss and the measures taken to attempt retrieval of the gear.

4. The authority in the Member state is entitled to reimbursement of costs incurred in retrieval of fishing gear not reported as lost by the captain of the fishing vessel.
5. A commercial fishing vessel of less than 12 metres may be exempt for the requirement presented in paragraph 1 if they only sail within the Member states territorial waters as well as if they spend less than 24 hours away from port at one time.
6. In addition, the council regulation specifies requirements on marking commercial fishing gear in *Article 8 - Marking of the fishing gear*. The article states that commercial fishing vessels, and the captain as the main responsible, are obligated to respect the EUs restrictions on clear marking and identification of both the vessel and its fishing gear. EC 356/2005 also dictates rules for the marking and identification of passive fishing gear (e.g. longlines and gillnets) and beam trawls (The European Commission, 2005).

2.1.3 Directive (EU) 2019/904

The Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment, also known as the single-use plastic (SUP) Directive, includes fishing gear made from plastic. According to investigations preceding the directive, about 80–85% of the marine litter within the EU is plastic which was approximated through beach litter counts. About 27% of the litter is fishing-related products. (European Parliament, 2019)

The SUP directive states that ALDGFs are included in legislations such as Regulation (EC) No 1224/2009, Directive 2000/59/EC and Directive 2008/98/EC. However, there is a lack of economic incentives for commercial fishers to collect and bring fishing gear to shore, Member states are required to implement an extended producer responsibility (EPR) scheme for gear containing plastic. This would incendivities separate collection and the financing of waste management, especially recycling, of end-of-life fishing gear. In addition, the Member states are required to monitor and assess reported losses of fishing gear in accordance with the requirements of the new EPR scheme. This also includes monitoring and reporting the amount of fishing gear put on the market as well as the waste fishing gear to the European Commission. A minimum collection rate of fishing gear being recycled is required for each member stat to introduce. The cost of the scheme is intended to be covered by the producers. This includes, in addition to the main obligations of the EPR scheme, measures to increases the awareness of ALDGFs. (European Parliament, 2019)

In the SUP directive defines important concepts regarding the EPR scheme. This includes defining *fishing gear,* waste fishing gear and *producer* as follows:

- 'Fishing gear' means any item or piece of equipment that is used in fishing or aquaculture to target, capture or rear marine biological resources or that is floating on the sea surface and is deployed with the objective of attracting and capturing or of rearing such marine biological resources (European Parliament, 2019).

- 'Waste fishing gear' means any fishing gear covered by the definition of waste in point 1 of Article 3 of Directive 2008/98/EC, including all separate components, substances or materials that were part of or attached to such fishing gear when it was discarded, including when it was abandoned or lost (European Parliament, 2019).

- 'Producer' means:
  (a) any natural or legal person established in a Member State that professionally manufactures, fills, sells or imports, irrespective of the selling technique used, including by means of distance contracts as defined in point (7) of Article 2 of Directive 2011/83/EU of the European Parliament and of the Council (21), and places on the market of that Member State single-use plastic products, filled single-use plastic products or fishing gear containing plastic, other than persons carrying out fishing activities as defined in point (28) of Article 4 of Regulation (EU) No 1380/2013 of the European Parliament and of the Council (22); or
  (b) any natural or legal person established in one Member State or in a third country that professionally sells in another Member State directly to private households or to users other than private households, by means of distance contracts as defined in point (7) of Article 2 of Directive 2011/83/EU, single-use plastic products, filled single-use plastic products or fishing gear containing plastic, other than persons carrying out fishing activities as defined in point (28) of Article 4 of Regulation (EU) No 1380/2013;

2.2 Fishing gear

Fishing gear includes several different items. Below we present some of the gear that are frequently mentioned in this report and occur as part of the survey-questions.

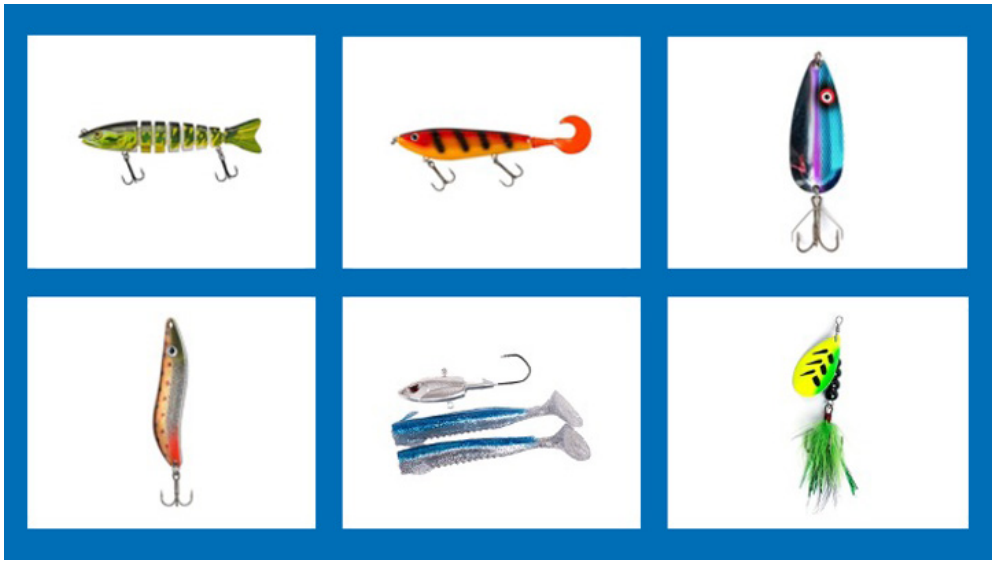

Figure 1: Different type of commonly used fishing baits and lures. Photo by fladenfishing.se

Figure 2: On the left and in the middle, pictures of two types of sinkers. To the right a picture of fishing line. Photo by fladenfishing.se

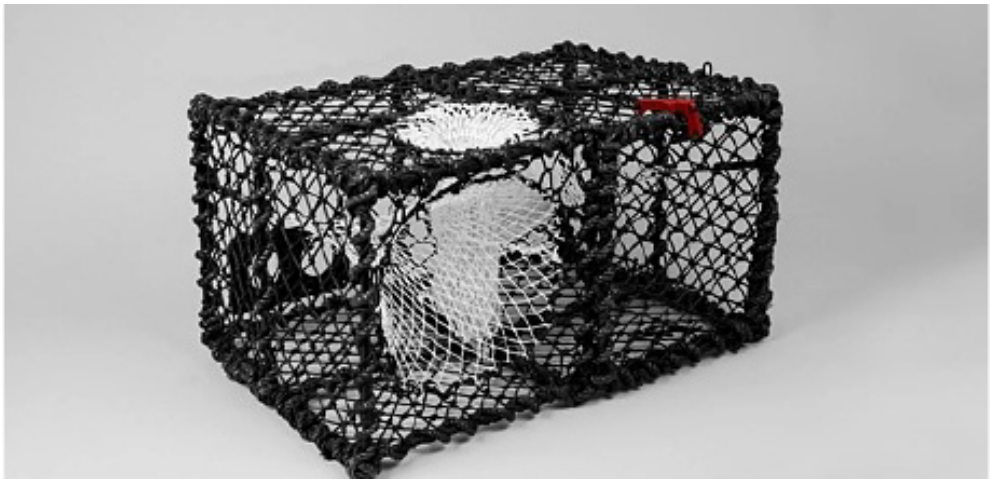

Figure 3: A type of crab-cage. Photo by carapax.se

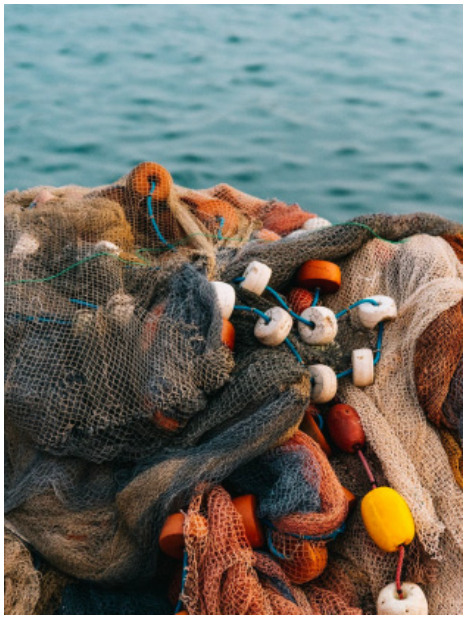

Figure 4: Different types of fishing nets. Photos by Krisztian Tabori and Hà Nguyễn on Unsplash

3 Methodology

We have used different approaches and methods in order to collect relevant data, information, and knowledge. A literature survey was conducted in combination with interviews and personal communication with relevant experts, organisations, and other stakeholders as well as gathering publicly available national statistics. In addition, a web survey directed towards sport and recreational fishing was developed with the aim to gain information on the loss of fishing gear by sport and recreational fishers.

Literature survey

The literature survey was partly based on articles provided by the Swedish Agency for Marine and Water Management (SwAM), Swedish Environmental Protection Agency (Swedish EPA) as well as the Nordic Council of Ministers. In addition, the survey included a search for scientific articles and informative webpages connected to relevant stakeholders. Literature databases such as Google Scholar was used for a systematic review of relevant studies. Search words included 'ALDFG', 'fishing gear', 'losses of fishing gear', 'Nordic countries', 'harmful chemicals', 'plastic' as well as various combinations and phrases including the selected words. Additional information was collected from scientific reports and research from both governmental sources and private sector. These were found by desk research as well as being provided by contacted stakeholders.

Stakeholder dialogue

Several experts, organisations, and national authorities with insight into fishing in the Nordic countries were contacted and interviewed. Contact details of relevant organisations and authorities were provided by SwAM and Swedish EPA as well as by the Nordic Council of Ministers. Additional stakeholders were found and contacted through own research as well as through contacted stakeholders who referred to other organisations and companies. This dialogue included stakeholders from all parts of the value chain of fishing gear such as manufacturers, retailers and organisations connected to sport and recreational fishing as well as those active in fishing tourism, marine recycling centres and local and national authorities. For a list of identified stakeholders connected to fishing in the Nordic countries, see Appendix I.

Questions covered in this dialogue included for example:

- Do you have any statistics/data on the amounts of fishing gear that is lost by commercial fishers and recreational fishers?
- How do you perceive the issue of lost fishing gear in both freshwater and marine environments? Have the amounts/issues increased or decreased in recent years?
- What are the possibilities of recycling fishing gear in your country?

- What measures have you implemented or do you intend to propose to reduce the amount of lost fishing gear.

Sales statistics from retailers and producers

Producers and retailers were contacted in order to collect sales statistics from several large companies operating in one or more of the Nordic countries. These included both companies specialized in the sale of fishing gear for sport fishing, as well as major sports and leisure shops. The contacted companies were initially based on members of Swedish Sport Fishing Trade (Svensk Sportfiskehandel) and mapped producers in Norway (Sundt et al., 2018). In the end, the collection of sales statistics could not be used to estimate the amount of fishing gear put on the market in the Nordic countries. The reasons for this are several, however, the data are considered sensitive to companies and therefore difficult to access.

National import and export statistics, and industrial production

A rough estimate of the amount of fishing gear put on the market each year was calculated according to equation 1 below.

Equation 1:
Put on the market (tonne)=Import (tonne)+Industrial production (tonne)-Export (tonne)

National import and export statistics were collected from each Nordic country's equivalent of the Central Statistical Office or Customs Services. All Nordic countries use the *Harmonized Commodity Description and Coding System* (HS), as a basis for classifying internationally traded goods. Groups of commodities are identified by a code of six or eight digits which allows a universal classification of goods traded between countries and acts as a basis for customs tariffs (European Commission, n.d.). The commodity codes (CN code) presented in Table 1, were identified to be directly linked to fishing gear.

Table 1: Included commodity codes (CN) considered in this project.

Heading number	CN code, 6-digits	Description
5608		Knotted nets of lashing yarn or rope, as a length or in fitted pieces; suitable fishing nets and other fishing gear of nets and other made-up articles of nets, of textile materials
	560811	Fishnets, made up of man-made fibres
9507		Fishing rods, fishhooks and other line fishing tackle; fish landing nets, butterfly nets and similar nets; decoy 'birds' (other than those of heading 9208 or 9705) and similar hunting or shooting requisites
	950710	Fishing rods
	950720	Fishhooks, whether or not snelled
	950730	Fishing reels

According to the Swedish Customs' guidance for the classification of goods, heading number 5608 includes manufactured fishing nets and other types of nets (Swedish Customs Agency, n.d.). The heading number is explained to include:

- Knotted nets made of lashing yarn or rope manufactured either by hand or by machines.
- Fitted nets with open meshes made by hand or by machines. These can either be ready for use or be delivered in larger pieces that require further processing. There may be additional needs that do not affect the classification of the goods, such as handles, rings, wights, and floats. Only goods that are not covered in more specific CN codes are included. For examples, **fishing nets**, camouflage nets, theatre decoration nets, safety nets, net bags hammocks, balloon and airship nets as well as insect protection nets. The products can have been treated to withstand certain conditions.

Moreover, products such as fishing rods, fishing hooks, fishing reels and other types of gear linked to sport and recreational fishing are included in heading number 9507. The heading number includes, according to the guidance from Swedish Customs, equipment such as (Swedish Customs Agency, n.d.):

- All kinds of **fishhooks** and sizes made from steel and may be, for example, bronzed.
- Landing nets, butterfly nets or similar nets consisting of textile yarn or textile laces attached to a handle.
- Fishing rods made of, for example, metal, plastic, or glass fibres.
- Fishing reels and mountings.
- **Artificial baits**, for example, **artificial fish**, **flies**, and **insects** as well as other equipment such as **baits,** floats, bells, and **weights**.
- Mounted ropes and throwing lines.
- Certain articles for hunting, such as decoy birds and larch mirrors.

Statistics on the annual industrial production in Sweden and Denmark was collected from each of the country's respective Central Statistics office. For the remaining countries, statistics on domestic production were found via PRODCOM, an EU database providing statistics of industrial production. Different goods are identified according to an 8-digit code. The relevant PRODCOM-codes identified to be relevant to fishing gear are presented in Table 2.

Table 2: PRODCOM-codes relevant for this study as well as the corresponding CN-codes and a description of the PRODCOME-code.

PRODCOM-code	Description	Assumed CN code
13941233	Made-up fishing nets from twine, cordage or rope of man-made fibres (excluding fish landing nets)	560811
1394235	Made-up fishing nets from yarn of man-made fibres (excluding fish landing nets)	560811
32301600	Fishing rods, other line fishing tackle; articles for hunting or fishing n.e.c.	Includes products in both CN code 950710 and 950790. It was assumed in this study that full amount accurses to code 950790.

Survey directed towards sport- and recreational fishers

Surveys directed towards sport and recreational fishers were developed in the web-based tool EasyQuest, see Appendix II. The form was translated into four languages, Swedish, Norwegian, Danish, and Finnish and was sent to relevant organisations in the Nordic countries. The questionnaires were published in, for example, newsletters and Facebook groups. The following organisations helped distribute the questionnaires:

- IVL
- Swedish EPA
- SwAM
- The Swedish boat union (Svenska båtunionen)
- The Keep Sweden Tidy Foundation (Håll Sverige rent)
- The fishing journal (fiskejournalen)
- Sportfishing organisation in Denmark (Sportsfiskerforbundet)
- Journal at Faeroe Islands (jn.fo)
- Facebook pages at Faroe Islands: Fisking Og Frítíð and Føroysk Sjófólk.

The survey included questions covering: the amount of gear lost each year (e.g., cages, baits, nets and fishing line), the number of fishing days per year, the type of water in which the person mainly fishes and the group of fishers in which the person considers himself to belong (i.e., sport or recreational fisher).

4 Results

4.1 Current status of the Nordic countries

The Nordic countries have reached different levels of insight, knowledge and efforts regarding the issue of fishing gear loss. The level of available data and the reporting here will therefore differ between the countries. However, the current situation in each Nordic country is generally presented as follows:

- A description of available applications for registration of lost fishing gear.
- Available statistics on lost fishing gear.
- Information gained from the stakeholder analysis.
- Previous studies on the subject.
- Statistics imports, exports and industrial production.

4.1.1 Sweden

In 2020, around 1.7 million people went fishing in Sweden including both sport and recreational fishers. This means that about 16% of the Swedish population goes fishing each year. The total number of days spent fishing was approximately 16.8 million out of which 70% took place near lakes and streams while the remaining 30% occurred at sea. Active fishing gear accounts for about 85% of fishing days while passive gear accounts for the remaining 15% (Enhol Blomqvist, 2021).

Sweden has multiple systems in place where both commercial and recreational fishers can register their losses of fishing gear. It is mandatory for commercial fishers to report losses of fishing gear within 24 hours to SwAM by use of the FMC (Fisheries Monitoring Center) system, see compiled data off losses in table 3. For recreational fishers the web-based tool 'GhostGuard' is available, a website where anyone can report losses or recovered fishing gear. However, according to SwAM the reported losses only partially cover the actual losses occurring in Swedish waters. Particularly, the reported losses in GhostGuard are an underrepresentation of the actual losses[2]. The underreporting of losses to FMC and GhostGuard may be caused by, for example, lack of information about the possibility to register losses as well as lack of legal ramifications. Moreover, GhostGuard has only been available for one and a half years and as such the tool has not reached its full potential at this point.

2. Communication with Swedish water and marine agency.

Table 3: An overview of losses and found fishing gear registered in FMC by commercial fishers. The amounts are presented as number of pieces (denoted as pcs).

	Types of fishing gear				
Year	Cages [pcs]	Nets [pcs]	Fishing line [pcs]	Other [pcs]	Total [pcs]
2016	10	0	0	4	14
2017	23	0	0	12	35
2018	23	0	0	1	24
2019	18	0	0	15	33
2020	1	0	0	12	13
2021	42	0	0	36	78
2019	18	0	0	15	33
2020	1	0	0	12	13

In addition to FMC and GhostGuard, the Swedish Police[3] receives reports on lost fishing gear. Lobster-fishers are well represented in this group as they are motived to report lost lobster cages, if not reported they may be given a fine if the cage is found outside of the lobster season. The data received from the Swedish police covers both losses reported by the public as well as items confiscated or found by the police (see Table 4). Items in both categories (mostly confiscated items) are being handled according to applicable law and are in some cases returned to the owner if the item is correctly marked, alternatively put back on the market if the item is in good shape.

Table 4: Data received from the Swedish police on confiscated objects and reports on lost equipment they have received between 2017 to 2021.

Type of fishing gear	Number of confiscated objects between 2017–2021	Number of reports on losses between 2017–2021
Baits and lures	2 689	848
Weights	122	0
Cages	3 799	14 332
Nets	690	875
Lines	1 009	2 081
Longlines	5	0
Trawl	1	0
2020	1	0

3. Police inspector at the legal department. Swedish police. Mail conversation January to February 2022.

The main challenge with the data received from the Swedish police is that it is difficult to quantify the actual amounts as well as type of gear lost. For example, in Table 4, the amounts reported as lost most likely reflect the number of reports and not the number of items. Thus, a report may include various types as well as multiple items. It can be discoursed that the reports to the Swedish police in most cases comes from recreational and sport fishers since commercial fishers might be more aware of the reporting system and reports their losses directly to the authorities. However, this remains uncertain.

Sweden has a marine recycling station in Sotenäs, which has collected data on the total amount of fishing gear processed at the station in 2021. Moreover, they can also provide data on the ratio between ghost nets and what has been collected by "Fiskereturen" an organisation for collecting old fishing gear in Sweden, see Table 5.

Table 5: Data on the amounts of fishing gear processed at the marine recycling station in Sotenäs during 2021.

Totally (tonne)	Ghost gear (tonne)	From recycling organisation (tonne)	Number of cages (pcs)
207	31	176	700

The marine recycling station mostly handles fishing gear from commercial fishing. The main challenge with recycling fishing gear is the mix of different materials and different types of plastics. Separating different materials and specific polymers is a labour-intensive process done by hand. Right now, the station in Sotenäs is recycling all kinds of materials including plastics such as polypropylene (PP), polyethylene (PE) and nylon. Due to the high content of additives in polyvinylchloride (PVC), the material is not recycled. Fishing gear in good condition is sorted out for re-use[4]. Moreover, Keep Sweden Tidy (Håll Sverige rent) collects fishing gear from beaches around Sweden. A potential source of data and understanding of the gear washing up on Swedish shores could be received from Keep Sweden Tidy. However, this has not been possible in this study.

According to estimations by Andersson & Eggert (2018), approximately 154 to 340 tonnes of fishing gear is lost annually in Sweden. The calculations are based on numbers presented by the EU stating that around 11 000 tonnes of gear may be lost or discarded in EU water each year. Based on the assumption that the losses are evenly distributed between the Members states, the estimation of Sweden's contribution were based on data regarding total landings and the value of landings, which was taken from Eurostat. The following figures were obtained, Sweden stands for 3.47% of the total landings in tonnes and the value of landings was 1.4% of the total value for the EU.

4. Project leader at Sotenäs marine recycling station. Online meeting in February 2022.

There seems to be an understanding of the problem of lost fishing gear within the Swedish fisheries. According to FF Norden[5], a Fisher's association, measures are taken by commercial fishers to recover their fishing gear when lost. Both due to the environmental impacts caused by ALDFGs as well as the equipment being costly and contributing to an economic impact on the fisher. In addition, organisations related to sport and recreational fishing in Sweden states that they aware of the environmental problems connected to ALDFG. Many organisations believe that net and cage fishing constitute a greater problem, contributing more to ALDFG, than recreational fishing with baits and lures does. It was pointed out that sport fishers are disturbed by the problem because of the large amount of fishing gear present in the sediment and water column as their gear got stuck in the lost equipment. One organisation reported being in favour of the introduction of a reporting system or other solutions to track the losses of sportfishing gear. However, they do not foresee any immediate solution to the problem.

According to FF Norden[6], domestic production of especially commercial fishing gear has decreased in recent decades. Production instead takes place abroad and fishing gear is imported from other countries. The amount of fishing gear put on the Swedish market in 2020 was estimated using data on imports, exports and goods production from Statistics Sweden's statistical database[7], see Table 6.

Table 6: Estimation of fishing gear placed on the market in Sweden during 2020 based on imports, domestic production, and exports.

CN code, 6-digits	Description	Import [tonne]	Industrial production [tonne]	Exports [tonne]	Put on the market [tonne]
560811	Fishnets, made up of man-made fibres	111	0	2	109
950720	Fish-hooks, whether or not snelled	73	0	29	44
950730	Fishing reels	179	N/A*	137	42
950790	Line fishing tackle n.e.s; fish landing nets, butterfly nets and similar nets; decoys and similar hunting or shooting requisites (excl. decoy calls of all kinds and stuffed birds of heading 9705)	671	0	318	353

* This value is not published due to poor data quality. Only a monetary value given in SEK could be retrieved which could not be recalculated into tonnes.

5. Mattsson, Jennie & Söderberg, Sixten. FF Norden. Interview 27th of January 2022.
6. Mattsson, Jennie & Söderberg, Sixten. FF Norden. Interview 27th of January 2022.
7. Foreign trade – exports and imports of goods (scb.se) and Production of commodities and industrial services (scb.se).

4.1.2 Norway

In 2020, about 37% of the population in Norway has been fishing at least once in the last year according to Statistics Norway's statistical database (Statistics Norway, n.d.). This corresponds to approximately 2 million people when assumed that the same figure is correct in 2022[8]. Household fishing, including both sport and recreational fishing, is limited to only allow the following fishing gear (Department for Fisheries, 2021):

- handheld tools such as fishing rods or poles.
- one machine-driven trolling line
- fish net with total length no more than 210 meters
- up to 20 lobster traps or crab traps

Norway is one of the more successful countries when it comes to management of lost fishing gear according to most contacted stakeholders. The nation depends on sustainable fisheries and a thriving local marine environment and fish population. Since 1980 it has been mandatory for commercial fishers to report losses of fishing gear to the Directorate of fisheries or the coast guard. The main reason was, at least in the beginning, to stop ghost-fishing. Today commercial fishers report their losses through the web-based tool FishInfo (FiskInfo) (BarentsWatch, n.d.). The Directorate of fisheries in Norway partake in annual operations to clean and retrieve as much lost gear as possible (Directorate of Fisheries, 2020). The reported losses are used as a basis for the focus areas for the yearly clean-up mission along the Norwegian coast (see compiled data off retrieved gears in Table 7). Today the cleaning operations focus on cages and hooks because of the risk of ghost fishing, but many other gears such as nets and fishing line are retrieved as well.

Table 7: An overview of found fishing gear, retrieved by The Directorate of fisheries yearly cleaning operations (Langedal, n.d.).

	Type of fishing gear		
Year	Cages [pcs]	Nets [pcs]	Fishing line and rope [m]
2017	147	815	43 400
2018	8689	765	310 960*
2019	1242	820	80 400
2020	2669	681	172 600
2021	82**	1029	94 000

* Extra removal of snowcrab-cages (Chionoecetes opilio).
** No removal of snowcrab-cages (Chionoecetes opilio).

8. The population in Norway is about 5 435 000 in 2022 according to Statistics Norway.

Due to these annual cleaning operations, it is well known in Norway that it is beneficial to register your losses. Otherwise, fishers might be fined if the gear is found later, and they will lose the chance to get it back. According to the Directorate of fisheries, this method works well due to the long and ongoing dialogue with fishers[9]. It is important that the fishers trust the authorities and have the possibility to get their gear back, otherwise the system would not work as well. Most commercial fishing gear are expensive, and losses are costly for a company and the incentive of getting the gear back contributes to fishers reporting their losses. Due to a disproportionate amount of fishing gear lost from recreational fishing, Norway has also introduced a requirement that people who want to participate in lobster pot fishing have to register in advance (Langedal et al., 2020).

It is not mandatory for recreational fishers to report their losses of fishing gear in Norway today, however, new legislation will be implemented in 2022. The legislation includes requirements that all fishing gear is marked, and losses of gear being reported by all recreational fishers in Norway. Since 2017, the Directorate of fisheries have a specific application for recreational fishers (Fritidfiskeappen) open for everyone to register their losses of gear as well as fishing gear that has been recovered. An overview of the registered losses as well as retrieved gear made in the application for recreational fishers since 2017 is presented in Table 8.

Table 8: An overview of losses and found fishing gear registered in "fritidfiskeappen" and found by divers. The amounts are presented as number of pieces (denoted as pcs). Data received from The Directorate of fisheries (Fiskeridirektoratet, 2022).

	Type of fishing gear				
Year	Cages [pcs]	Nets [pcs]	Fishing line [pcs]	Other [pcs]	Total [pcs]
2017	125	1	0	10	136
2018	176	11	1	6	194
2019	478	11	0	2	491
2020	4 949	119	19	79	5 166
2021	5 483	156	25	41	5705

Sport fishing is yet to be considered when it comes to registration losses of fishing gear in Norway, which is also the case for other Nordic countries. It is not possible to register the loss of baits or other items more commonly used by sport fishers. According to the Directorate of fisheries and the Norwegian centre against marine litter, sportfishing is contributing to marine litter and organisations related to sport fishing will hopefully be more aware off the problem in the future. However, right now the national focus is on recreational fishing and not sport fishing[10]. The largest

9. Senior advisers at Miljødirektoratetet, senior adviser at Senter for marin forsøpling. Online meeting in May 2022.
10. Senior advisers at Miljødirektoratetet, senior adviser at Senter for marin forsøoling. Online meeting May 2nd 2022.

collective of sport fishers is the Norwegian hunting and fishing organisation (Jakt & fiske, NJFF). Several attempts were made to get their point of view; however, none were successful.

Norway has a domestic production of commercial fishing gear (Skogesal & Fasting, 2022), compared to some of the other Nordic countries such as Sweden. For example, Norwegian producers include Egersund Herøy, Skagerak Trål og Notbøteri A/S and Åkrehamn Trålbøteri AS which produces fishing gear such as bottom trawls, prawn trawlers and crab pots.

In Norway, two reports on the subject of extended producer responsibility of plastic fishing gear have been carried out by Mepex on behalf of the Norwegian Environment Agency in recent years. The latter was published in 2022 and estimates that about 6 200 tonnes of fishing gear suitable for commercial fishing was put on the market in 2020. For recreational fishing the same value was estimated to about 430 tonne (Skogesal & Fasting, 2022). Data on imports and exports from Statistics Norway's statistical database[11] is presented in see Table 9. In addition, industrial production for the year of 2020 was taken from PRODCOM. When estimated through imports, exports and industrial production, the amount put on the market is higher than that estimated by (Skogesal & Fasting, 2022).

11. 08801: External trade in goods, by commodity number (HS) and country 1988 – 2021. Statbank Norway (ssb.no)

Table 9: Estimation of fishing gear placed on the market in Norway during 2020 based on imports, domestic production, and exports.

CN code, 6-digits	CN code, 8-digits	Description	Import [tonne]	Industrial production [tonne]	Exports [tonne]	Put on the market [tonne]
560811	-	Fishnets, made up of man-made fibres, total amount	7 105	3 635	3 183	7 714
	56081101	Cages with nets, tied, of synthesizers or textile materials	467	N/A	43	433
	56081102	Ready-made fish nets made of polyamide monofilaments, omissions/ pots	214	N/A	37	177
	56081103	Ready-made fish nets made of polyamide multifilaments, omissions/ pots	2 087	N/A	2 470	-383
	56081104	Ready-made polyethylene fishing nets, excluding cages/pots	357	N/A	146	211
	56081109	Ready-made fish nets made of synth/art textile materials (excluding polyamide and ethylene), not cages/pots	3 972	N/A	310	3 661
950720	-	Fishhooks, whether or not snelled	587	0	0	587
950730	-	Fishing reels	64	0	1	61
950790	-	Line fishing tackle n.e.s; fish landing nets, butterfly nets and similar nets; decoys and similar hunting or shooting requisites (excl. decoy calls of all kinds and stuffed birds of heading 9705)	736	N/A*	27	709

*A value not given in PRODCOM; however, this does not mean that the value is equal to zero. Rather the value is not presented due to confidentiality.

4.1.3 Denmark

There are around 0.3 million sport- and recreational fishers in Denmark, which constitutes about 5% of the population (Fisheries Board, n.d.). It is mandatory for commercial fishers to report losses of fishing gear to the Danish fishery council (Fiskeristyrelsen) (Directorate of Fisheries, n.d.) within 24 h. According to the Danish fishery council this requirement will include recreational fishers from 2022. Recreational fishing equipment also needs to be marked so that identification of the owner can be made possible (Langedal et al., 2020). While this data is currently not publicly available, work is ongoing to provide access to the data through their website. Based on a dialogue with both the Danish authorities and NGOs, the issue of lost fishing gear originating from sport and recreational fishing has not been as discussed as for commercial fishing. In addition, the Danish sportfishing organisation (Sportsfiskerforbundet) does not have any insight into the amount of fishing gear might be lost by their members annually. Denmark's organisation for recreational fishers was also contacted, but no reply was received.

In Denmark they have a national prohibition of lead. The legislation was introduced in 2006 and today almost all kinds of products containing lead are banned (Miljøministeriet, 2020). Because of the use of lead in fishing products, such as weights and sinking ropes, the Danish legislation has a positive impact on the aquatic environment. Pedersen et al. (2021) investigated the occurrence and consequences of ghost nets in conflict areas or zones in Danish waters. Conflict areas or zones are defined as areas where a high occurrence of passive fishing gear coincides with heavy maritime traffic and active fishing. The authors estimated that if an international standardized trawl would trawl the entire Danish Sea floor, the trawl would catch approximately 0,45 net pieces/km^2 and an entire amount of 49 000 net pieces. It was also concluded that the conflict areas do not harbour the largest amounts of ghost nets (Pedersen et al., 2021).

The amount of fishing gear put on the Danish market in 2020 was estimated using data on imports, exports and goods production from Statistics Denmark's statistical database[12], see Table 10.

Table 10: Estimation of fishing gear placed on the market in Denmark during 2020 based on imports, domestic production, and exports.

CN-code	Description	Import [tonne]	Industrial production [tonne]	Exports [tonne]	Put on the market [tonne]
560811	Fishnets, made up of man-made fibres	2 262	686	1 073	1 875
950720	Fishhooks, whether or not snelled	82	0	26	56
950730	Fishing reels	87	0	4	83
950790	Line fishing tackle n.e.s; fish landing nets, butterfly nets and similar nets; decoys and similar hunting or shooting requisites (excl. decoy calls of all kinds and stuffed birds of heading 9705)	743	0	470	273

12. Statbank Danmark and Statbank Danmark.

4.1.4 Finland and Åland

Fishing is one of Finland's most common outdoor activities, every year approximately 1.5 million finish people go fishing, including both recreational and sportfishing (Naturresursinstitutet, 2020). This means that about 28% of the population participating in fishing activities each year. No statistics has been found for Finland regarding quantity of fishing gear lost each year, both from commercial and recreational fishers. Despite article 48 in EU regulation no. 1224/2009, the Finnish authorities[13] do not have measures in place to report the loss of fishing gear and to tackle ghost fishing. Currently there is also no obligation for either commercial or recreational fishers to report the loss of fishing gear. There is however, a "lost and found" public application (only available in Finnish) designed for the registration of fishing gear, which was published recently. However, the Finnish Environment Institute (SYKE) has been carrying out a pilot study in 2019 to estimate the amount of ghost gear in Finnish marine waters on the west coast (SYKE Finnish Environment Institute, 2019). In addition, tests were carried out to study methods to process the collected fractions into recyclable materials. The pilot study aimed to estimate the costs of processing collected ghost gear into recyclable materials.

Seppänen & Lappalainen (2019) investigated fishing and fish farming as a source of plastic waste in the Baltic Sea. The authors provide a rough estimate on the amount of plastic waste produced through fishing in Finland. The authors calculated that approximately 17.5 tonnes of plastic are released annually into the sea from fishing gear, which are attributed to traps and trawls. The release of microplastics derived from commercial fishing nets into the Baltic Sea was estimated to about one tonne per year. Whereas the release of microplastics from recreational fishing nets was estimated to be twice as much due to the extent of the losses. The total estimated quantity of marine litter directly derived from fishing activities and loss of gear was 20 tonnes annually (Seppänen & Lappalainen, 2019).

The issue of ALDFG is relatively known in Finland. The two studies from 2019, which were described above, show that Finland has started to take steps towards different ways of understanding and dealing with the problem. Another relevant study is conducted by a master student Anni Jylhä-Vuorio from the University of Helsinki. Jylhä-Vuorio is currently investigating plastic debris in Cormorant nests as a member of Syke marine litter research team in the Gulf of Finland. They surveyed 200 nests and found a total of 250 plastic items from the nests, from which approximately 10% were fishing gear such as pieces and fragments of nets and cages (Jylhä-Vuorio, 2022). However, even though there are studies that shows a growing commitment to dealing with the problem of ALDGF, all are not of the same opinion. One of the Finnish organisations contacted in this study are of the opinion that the problem does not exist at all in Finland and that Finish waters contain only negligible amounts of lost fishing gear.

The amount of fishing gear put on the Finnish market in 2020 was estimated using data on imports, exports, and goods production from Finland's Customs statistical database[14] and Statistic Finland's statistical database[15], see Table 11. Industrial production for the year of 2020 was taken from PRODCOM.

13. Senior Researcher at the Marine Research Centre. Finnish environment institute (SYKE). Email contact January 2022.
14. Tulli, Tilastotietokanta – Verti
15. Industrial output by PRODCOM heading by PRODCOM, Year and Information. PxWeb (stat.fi).

Table 11: Estimation of fishing gear put on the market in Finland during 2020 based on imports, domestic production, and exports.

CN-code	Description	Import [tonne]	Industrial production [tonne]	Exports [tonne]	Put on the market [tonne]
560811	Fishnets, made up of man-made fibres	129	0	6	123
950720	Fishhooks, whether or not snelled	60	0	16	44
950730	Fishing reels	70	0	28	42
950790	Line fishing tackle n.e.s; fish landing nets, butterfly nets and similar nets; decoys and similar hunting or shooting requisites (excl. decoy calls of all kinds and stuffed birds of heading 9705)	362	...*	241	121

* Only a monetary value given in Euro could be retrieved which has not been able to be recalculated into tonnes.

4.1.5 Iceland

Since 2021 Iceland have a legislation in place regarding registration of lost fishing gear for commercial fishermen. It is the Icelandic coast guard and Directorate of Fisheries that handels the reports and compiles the statistic. Since the legislation is quite new, the amount of reported losses are still low. According to the Directorate of Fisheries, Iclandic fishers needs more education about the legislation and become more aware of the marine litter situation[16]. Which is something they are currently working on. Recreational fishers are covered by certain regulations. For example, they are only allowed to use hand held gear. Traps and mecanicaly driven equipment is not allowed. The amount of fishing gear put on the Icelandic market in 2020 was estimated using data on imports, and exports from Statistic Iceland's statistical database[17], see Table 12. Industrial production for the year of 2020 was taken from PRODCOM.

Table 12: Estimation of fishing gear put on the market in Iceland during 2020 based on imports, domestic production, and exports.

CN-code	Description	Import [tonne]	Industrial production [tonne]	Exports [tonne]	Put on the market [tonne]
560811	Fishnets, made up of man-made fibres	374	0	78	296
950720	Fishhooks, whether or not snelled	50	0	10	40
950730	Fishing reels	5	0	0	5
950790	Line fishing tackle n.e.s; fish landing nets, butterfly nets and similar nets; decoys and similar hunting or shooting requisites (excl. decoy calls of all kinds and stuffed birds of heading 9705)	57	0	11	45

16. Head of surveillance at sea, Fiskistofa. Mail contact Mars 2022.
17. PX-Web - Select table (hagstofa.is)

4.1.6 Faroe Islands

The report "Når havets aktører opsamler affald i havet" (Nordic Council of Ministers, 2021) was brought up frequently in discussions with the Environmental Agency of Faro Islands. A follow up project on this report will be conducted in 2022. In the Faroe Islands, it is not mandatory for commercial fishers to report the loss of fishing gear, therefore there are no statistics available regarding these losses. In the report (Nordic Council of Ministers, 2021), as well as in discussions with the environmental agency it is clear that the awareness on the issue with ALDFG has increased significantly in Faroe Islands in later years. This is reflected by, for example, fishers bringing in their old fishing gear as well as fishing gear they recover from the sea to the harbours in a much higher rate than earlier. The fishing gear is later sent to recycling. According to the environmental agency, the focus in the follow-up project to the 2021 report, will partly be about solving the issue of fishers having to pay to deliver marine litter to the harbour in some part of the Faroe Islands.

Contact with local fishing-organisations in Faroe Islands was mainly limited to tourist related fishing tours, focusing mostly on fly fishing. In dialogue with two of these organisations, it was pointed out that Faroe Islands has very little sportfishing and recreational fishing and almost only fly-fishing activities. This contributes to other types of loss gear compared to, for example, conventional sport fishing. The IVL survey of lost fishing gear was shared by the newspaper *jn.fo*, as well as the two Facebook groups *Fisking Og Frítíð* and *Føroysk Sjófólk* on Faroe Islands. As flyfishing is the dominant type of recreational fishing in the Faroe Island, the spread of the survey may have been hindered by the fact that it was not suitable for larger organisations focused on flyfishing.

Fishing gear placed on the market in Faroe Islands based on imports, exports and domestic production has not been estimated in this project as no such statistics could be found. A potential approach would be to extrapolate a value of the amount based on those estimated for the other Nordic countries. However, based on the small population and differences in fishing culture and employment, such an approach is not considered to provide usable figures.

4.1.7 Greenland

Greenland does not have any official statistics on the loss of fishing gear. However, there is a report from 2021 about hotspots in the marine environment, where lost fishing gear tends to gather (Naalakkersuisut, 2021). According to the authorities on Greenland, work is ongoing to create an electronic solution for the registration of lost fishing gear that would in turn provide Greenland with statistics over the losses. A small number of projects focused on the removal of ghost gear has also been conducted. Overall, Greenland considers the issue of ALDFG to be serious as they themselves are also affected by it. These projects have resulted in reuse of fishing gear where both marked equipment could be returned to the owner and local fishers had access to second-hand gear in good condition. Otherwise, Greenland do not have any local solutions for the recycling of fishing gear. Some municipalities in Greenland send used gear to Plastrix AS in Denmark for recycling.

The fishing-industry in Greenland is important and both the problem with ghost fishing, littering and pollution are affecting the fishing fleet. In the same report from 2021, a chapter about further measurements to reduce the fishing gear loss was presented. This report also mention that lead restrictions are something that Greenland works with. According to Greenland authority they are working on legislation concerning a total ban of lead[32]. The search for recreational and sportfishing organisations in Greenland was unsuccessful. Recreational fishing is likely to be common and widespread across the country because many families fish for household purposes. However, no organisation could be found for further discussions within the timeframe of this project. From what was learned through discussions with local organisations, sportfishing in Greenland is mostly limited to fly fishing activities and the loss of gear are therefore very limited.

Fishing gear placed on the market in Greenland may be estimated entirely from imports. Greenland does not export any fishing gear considered in this project, and the domestic production is assumed to be non-exiting[18]. This study thus assumes that imports are the same as the quantity put on the market.

Table 13: Estimation of fishing gear put on the market in Greenland during 2020 based on imports.

CN-code	Description	Import [tonne]	Industrial production [tonne]	Exports [tonne]	Put on the market [tonne]
560811	Fishnets, made up of man-made fibres	133	0	0	133
950720	Fish-hooks, whether or not snelled	3	0	0	3
950730	Fishing reels	0.2	0	0	0.2
950790	Line fishing tackle n.e.s; fish landing nets, butterfly nets and similar nets; decoys and similar hunting or shooting requisites (excl. decoy calls of all kinds and stuffed birds of heading 9705)	29	0	0	29

18. Skårhøj, Ditte. Government of Greenland. Email conversation May 2022.

4.2 Results from the survey

The survey generated 449 answers all together, whereof 386 respondents where from Sweden, 49 from Denmark and Faeroe Islands as well as 14 respondents from Finland. As the same version of the questionnaire, the one in Danish, was sent to both Denmark and Faeroe Island, no distinction could be made regarding how many answers were received for each country. However, the spread of the questionnaire in Norway, Greenland or Iceland was unsuccessful. All were asked the same questions, however, in the language that the intended target group was assumed to speak. The questions were as follows:

1. How many days per year do you go fishing?
2. What kind of fishing do you engage in? Sport or recreational fishing?
3. How many cages (pots, Russians, gulls) do you lose per year?
4. How many nets do you lose per year?
5. How many sinkers do you lose per year?
6. How many meters of line do you lose per year?
7. How many baits do you lose per year?
8. What kind of bait do you mostly lose (spinners, jerkbaits, softbaits, spoon-lures)

In Table 14, a summary of the results obtained from the survey is presented. A more in-depth results for some of the questions can be found in Appendix III. The results correspond to a summary of all 449 respondents that was attained in some of the Nordic Countries. As there was a large range of answers for many of the question, a median value was considered more reliable than an average value of lost fishing gear. Moreover, even though most of the received answers originated from the Swedish version of the questionnaire, the results are assumed to be representative for all Nordic countries.

Out of the respondents, 69% consider themselves sport fishers while 31% considered themselves a recreational fisher. The median number of fishing days was 30 days and around 2 sinkers, 25 meter of fishing line and 5 baits are lost per each recreational and sport fisher each year in the Nordic countries. However, when it comes to cages and nets no estimations could be made as only a few registered losses of these types of gear.

Based on the obtained results from the survey, there are signs that the results are mainly representative for sport fishers. Initially about two thirds of the respondents consider themselves to be sport fishers. In addition, the median number of fishing days is 30 per fisher and year which is a high number. In this study, it is however assumed that the values are representative for both sport as well as recreational fishers.

Table 14: Summary of the 449 answers received including the median value for each question as well as a comment on the most important information of the results for each question.

CN-code	Description	Import [tonne]
Nr. 1: Fishing days	30 days	The range of the answers covers 0 to a maximum of 300 fishing days per year.
Nr. 2: Type of fishing	-	Out of the ones that answered 69% considered themselves sport fishers while 31% considered themselves recreational fishers.
Nr. 3: Lost cages	0	Only a very small number of losses were reported in the questionnaire.
Nr. 4: Lost nets	0	Only a very small number of losses were reported in the questionnaire.
Nr. 5: Lost sinkers	2	The range of the answers covers 0 to a maximum of 1 500 lost sinkers per year.
Nr. 6: Lost fishing line	25	The range of the answers covers 0 to a maximum of 300 metres of lost fishing line per year.

4.3 Estimations of lost fishing gear in the Nordic countries

The estimations of lost fishing gear in the Nordic are based on either the answers received from the questionnaire or on national statistic on imports, exports, and industrial production. The two different approaches utilised for estimating losses of fishing gear I the Nordic countries are based on completely different assumptions and sources of data. When studying the results and calculations, the reader must take these different methods as two separate approaches and not comparative.

4.3.1 Losses based on results from the questionnaire

The losses of fishing gear based on the results from the questionnaire only allows estimations of losses of baits, fishing line and sinkers. For the total amount of each gear type lost per year in the Nordic countries, the total amount of recreational and sport fishers in Sweden, Denmark, Norway, Finland, Iceland, Greenland, and Faroe Islands was combined. For Sweden, Norway, Finland, and Denmark national statistic of the number of recreations fisher was found. This corresponds to around 1.7 million in Sweden, 2 million in Norway, 0.3 million in Denmark and 1.5 million in Finland. For Iceland, Greenland, and the Faroe Islands an estimation was made based on the population size in each country and an average percentage of recreational fishers in the countries with known statistics. The average number of recreational fishers was estimated to be around 21.5% of the population. This correlates to approximately 77 000 recreational fishers in Iceland, 10 000 in the Faroe Islands and 12 000 in Greenland.

Based on this method, the Nordic countries have about 5.6 million active recreational and sport fishers all together. The number of recreational fishers in each country as well as the total amount in the Nordic countries was multiplied with the amount of gear lost per person and year based on the results from the questionnaire. The total losses of baits, fishing line and sinkers should only serve as a rough estimation due to

statistic bias. Moreover, the respondents are likely not completely representative for recreational fishers in general, see Table 15.

Based on the questionnaire, the number of baits lost each year by recreational and sport fishers in the Nordic countries corresponds to about 28 million. In the report by Skogesal & Fasting (2022), a bait was assumed to weigh roughly 10 grams. If the same assumption is applied, the total weight of the baits would correspond to approximately 280 tonnes of lost each year in the Nordic countries. Meanwhile, the loss of fishing line is estimated to be around 140 million meters and 11.2 million sinkers are estimated to be lost each year. However, as these estimations are rough and based on various assumptions as well as only a low number of respondents on the questionnaire, the values should not be considered as the absolute losses. Rather, the values should be seen as an indication of possible losses in the Nordic countries.

Table 15: Total amount of lost gear per year in the Nordic countries as well as the total amount in all countries together. Losses of fishing line is presented in meters while baits and sinkers are presented as pieces (psc) lost.

Country	Baits [psc]	Fishing line [m]	Sinkers [psc]	Comment
Sweden	8 500 000	42 500 000	3 400 000	Based on the assumption that 5 baits, 25 meters and 2 sinkers are lost per recreational and sport fisher each year.
Norway	10 000 000	50 000 000	4 000 000	
Denmark	1 500 000	7 500 000	600 000	
Finland & Åland	7 500 000	37 500 000	3 000 000	
Iceland	385 000	1 924 000	154 000	
Faroe Islands			51 000	
Greenland	59 000	296 000	24 000	
Total for all Nordic countries	**27 995 000**	**139 977 000**	**11 198 000**	

4.3.2 Losses based on estimations of the annual amount of fishing gear put on the market

National statistics on imports, exports and industrial production does not specify the intended user of fishing gear. The values received are thus connected to both recreational, sport and commercial fishing and a distinction between these stakeholders is not possible. However, due to different behaviours and utilised equipment between the fishers, it can be assumed that some of the CN codes are related to either sport or recreational fishing and others to commercial fishing. For example, sport and recreational fishing is more connected to fishing reels whereas fishnets may be more connected to commercial fishing.

Table 16: Summary of estimated amounts put on the market in each Nordic country.

Country	560811 (Fishnets, made up of man-made fibres) [tonne]	950720 (Fish-hooks, whether or not snelled) [tonne]	950730 (Fishing reels) [tonne]	950790 (Line fishing tackle; etc.) [tonne]
Sweden	109	44	42	353
Norway	7 714	587	63	709
Denmark	1 975	56	83	273
Finland & Åland	123	44	42	121
Iceland	296	40	5	45
Faroe Islands	N/A	N/A	N/A	N/A
Greenland	133	3	0.2	29

Based on the estimated amount of fishing gear put on the market in the Nordic countries in 2020, the amount lost at sea and in other waters was approximated based on assumptions. From national statistics on imports, exports and industrial production have losses of a couple fishing gear been estimated, including the fishing gear marked in bold below:

- Passive fishing gear including **traps**, **cages**, **pots**, and **fishing nets**.
- Active hand-held fishing gear including **lures**, **baits**, and weights with corresponding **hooks**, **lines**, and light components.

Fishhooks, lures and baits

Losses of fishhooks are a widespread problem in all Nordic countries according to the results from the survey. Many stated that they have lost baits, lures, and other types of gear utilising hooks. In the report by (Sundt et al., 2018), it was estimated that over 1 000 000 fishhooks are lost and over 1 000 000 fishhooks are placed on the market annually. Based on this, an assumption that fishhooks released on the market largely compensate for the loss of gear is adopted in this study, however, this is a very uncertain measure and therefore the uncertainty of the result should be highlighted. The amount of lost fishhooks, lures, and baits was calculated based on CN code 950720. The entire estimated amount placed on the market for this CN code is assumed to consist of the mentioned gear, however, the hooks are assumed not to be snelled.

Fishing line

All new fishing reels require a new fishing line. Based on CN code 950730 covering fishing reels, the amount of fishing line put on the market is estimated according to an assumption that a fishing reel weighs around 200 to 300 grams[19] and contains between 100 to 200 meters fishing line (Skogesal & Fasting, 2022). However, the estimated amount of fishing line put on the market does not cover the total amount put on the market each year. Fishing line is also sold per roll as well as older fishing reels are turned in to shops to discard the old line and replace by a new line. In addition, CN code 950890 may also include fishing line which is not taken into account in this study.

19. This assumption was made based on information from a market leading producer of fishing reels.

According to estimations by Richardson et al. (2019), the overall loss for all types of fishing line is 29%. The highest loss was found for pole-lines 65% while the lowest was for longlines 20%. The meta-analysis and the result are mainly directed to fisheries; however, it is assumed that similar losses are found for sport and recreational fishers. In this study it is approximated that 65% of the estimated amount of fishing line put on the market is lost each year.

Fishing gear containing fishing nets (e.g., fishing nets, traps, pots, trawls)

Fishing nets, traps and pots are lost to a varying degree depending on aspects such as type of gear and the kind of bottom in the area it is used. CN code 560811 covers fishing nets made up of man-made fibres. However, it does not specify whether the nets are used in production of other products such as trawls, pots or cages or if the nets are ready for use. A more in-depth distinction of different fishing gear has not been able to be made based on imports, exports and industrial production. Thus, a total amount of fishing net lost from a range of fishing gear including e.g., trawls, seins, pots, cages, fishing nets was estimated. The estimation of fishing gear made from fishing nets includes losses and fishing gear connected to recreational and commercial fishing a like. Since commercial fishing gears are generally a lot bigger than recreational fishing, the losses could be assumed to be mostly connected to commercial fishing.

According to Richardson et al. (2019), approximately 5.7% of all types of nets are lost and 8.6% of all pots and traps. For fishing nets, the lowest rate of loss is found for Miscellaneous nets 1.2% and the highest for net fragments from bottom trawls 26%. Meanwhile, for pots and traps the lowest rate of loss was identified for fyke nets 2.4% and the highest for pots used on a hard bottom 25%. The meta-analysis and the result are mainly directed to fisheries; however, it is assumed that similar losses are found for commercial and recreational fishers. This assumption is a cause of concern as commercial and recreational fishers utilises different gear and losses may vary depending on the level of expertise of the fishers themselves. However, the estimation gives a rough idea of the potential loss of fishing nets, traps and pots each year. In this study, it was assumed that between 5 to 10% of all fishing gear containing fish nets put on the market each year is lost.

In total, around 775 tonnes of fishhooks, 78 million to 235 million metres of fishing line and 520 to 1 040 tonnes of fishing gear containing fishing nets are lost in the Nordic countries each year. The losses directly correlate to the estimated amount of fishing gear put on the market each year in respective countries. However, these estimates are rough, and the values should not be considered absolute but rather as indications of possible losses in the Nordic countries.

Table 17: Estimated amounts of lost fishing gear based on import, export and domestic production from 2020, presented as weight of total losses per year. Values that have not been estimated is defined as Not available (N/A) in the table.

Country	Fish-hooks [tonnes]	Fishing line [metre]	Fishing gear containing fishing nets (e.g., fishing nets, traps, pots, trawls) [tonnes]	Assumptions
Sweden	44	14 000 000– 42 000 000	5.5–11	Based on the assumption that all fishhooks put on the market compensates for lost fishing gear. In addition, 65% of the fishing line as well as 5% to 10% of the fishing gear containing fishing nets are lost each year of the amount put on the market.
Norway	587	21 000 000– 63 000 000	386–771	
Denmark	56	27 700 000– 83 000 000	99–198	
Finland & Åland	44	14 000 000– 42 000 000	6–12	
Iceland	40	1 670 000–5 000 000	15–30	
Faroe Islands	N/A	N/A	N/A	
Greenland	3	67 000–200 000	6.7–13	
Total for all Nordic countries	**774**	**78 437 000235 200 000**	**518–1 035**	

4.4 Harmful substances from lost fishing gear

Fishing gear comes in many different sizes and shapes, adapted to a wide range of catching techniques. Historically, fishing gear was made of wood and natural fibers. Today, wood and natural fibers have to a large extent been replaced by metal and plastic. Because of the large amount of fishing gear that are used and lost at sea, their presence is likely to have negative effects on aquatic ecosystems. Plastic additives and associated chemicals constitute a plethora of harmful substances that can be leached from plastic materials (Deanin, 1975). Fishing plummets made of lead are also a problem, although the use of lead is already banned in certain countries, such as Denmark (Thomas et al., 2019). In Sweden, voluntary local prohibitions exist on the use of lead sinkers in some rivers such as parts of the Kalix river (Fiskekort.se, n.d.).

Plastic parts related to fishing gear may have different impacts on marine ecosystems. Firstly, there is the issue of plastic fishing gear causing physical damage to living organisms. For example, ghost nets that continue to trap and kill fish when they are abandoned or lost at sea, or nets and cages that can trap sea mammals, birds and turtles thereby injuring and potentially killing the animals as well as disturbing sea bottom habitats. Secondly, the lost fishing gear made of plastic materials can contribute to micro- and nanoplastic pollution of the oceans due to plastic degradation and weathering. Thirdly, different kinds of plastic additives and associated chemicals will eventually leak from the plastic during its degradation.

The most common types of plastic used in fishing gear are Polyethylene (PE), Polypropylene (PP), Polyvinyl chloride (PVC) and Polyamide (PA or nylon). While plastics can have widely different chemical properties and structures, all types of plastic will eventually break down to micro- and nano-plastics, it is just a matter of time (Poulsen, 2020). The major degradation pathways for marine plastics are through embrittlement enhanced by exposure to UV-light and physical forcing from winds and waves, in which the plastic degrades to smaller and smaller particles (Andrady, 2011). UV-radiation affects the plastic by causing chain reactions that affects the polymer and continues to degrade the plastic. For PE, the UV light starts the photochemical reactions creating free radicals. Eventually the plastics molecular structure is altered, and the plastic becomes fragile and brittle (Ter Halle et al., 2017). Polyamide or nylon is a more durable and long-lived plastic than PE (Tachibana et al., 2013). The heavy polyamide also tends to sink to water depths where the UV radiation is reduced and where degradation is slower. Overall degradation of plastic materials is considered to be slower in deeper waters than on land. In shallow waters it can be faster depending on the type of bottom and bottom currents (Harris, 2020). The colder temperature and the reduced amount of oxygen are two reasons for that (Andrady, 2011). In the Nordic regions, because of a colder climate and fewer hours of sunlight, the degradation rate is often hypothesized to be slower than in tropical regions. This could lead to fishing gear remaining in the Nordic ecosystems for a longer period of time and causing problems like ghost fishing, habitat deformation and dispersion of invasive species (Axelsson, 2021).

The effects of microplastics on marine biota is not fully understood. However, microplastics are known to be ingested by marine organisms including commercial species (Van Cauwenberghe and Janssen 2014, Granberg et al. 2020). Several studies have addressed the effects of microplastics on marine organisms. Some green algal species have been shown to absorb nano plastics causing reduced photosynthesis and increased production of radical oxygen species (ROS) (Bhattacharya et al., 2010). Another study on the water flea (Daphnia magna) did not show any significant toxic effect of microplastics or their additives on the growth and mortality (Schrank et al., 2019). The Swedish environmental protection agency states that the presence of microplastic at its current concentrations is not a hazard to the environment, but that knowledge in this field is insufficient (Naturvårdsverket, 2019).

It is important to understand the toxic effects from additives and the toxic effects from the actual microplastic. Some common additives in plastics are stabilizers, fillers, colorants, antioxidants, flame retardants and plasticizers (Deanin, 1975; Suhrhoff & Scholz-Böttcher, 2016). One group of plasticizes are phthalates, of which a subset of substances has been shown to cause endocrine disrupters and are therefore regulated in REACH (Kemikalieinspektionen, 2021). Still, other sorts of phthalates are used. In fishing lures made of soft plastics high amounts of phthalates have been detected. A mapping study from several Swedish municipalities analyzed 17 different kinds of fishing lures. The results showed that 15 out of 17 lures contained some kind of phthalate and that 6 out of 17 lures contained the phthalate DEPH (Stockholms stad, 2017), which is banned for use in the EU (EU commission regulation, 2018). A study made on both new and used plastic concluded

that plastic in several fishery items, e.g. ropes made of PP or PE and different float items, contained several kinds of additives and that the additives were found to be leaching out in the marine environment (Rani et al., 2015). However, a Swedish company producing fishing gear, interviewed in this study, stated that they are very selective with the additives used in their products and that they mostly use PE plastic only containing one UV stabilizer and ash as additives.

4.4.1 Softbaits

According to a Swedish producer of fish lures, the use of softbaits has increased substantially. Previously, spinners, wobblers and other baits made of metal and hard plastic were more commonly used, while today more and more of these baits are replaced by softbaits. While Swedish produced softbaits are made in accordance with EU chemical legislation and recommendations, imported softbaits often are made of PVC and have been shown to contain forbidden and harmful plasticizers (Stockholms stad, 2017). Softbaits are likely possible to import to EU because the baits are part of an exception. The Swedish chemical agency state on their website that goods for outside use that not come in contact with human mucous membranes, are not included in the EU legislation of phthalates (Kemikalieinspektionen, Begränsningar, 2022). It is thus reasonable to believe that fishing lures such as softbaits are included in that exception.

4.4.2 Lead

As briefly mentioned in the result for Denmark. Lead is a well-studied substance that is toxic to marine organisms. Lead released from fishing weights and ammunition are two routes of transmission that particularly harms seabirds, but also many other organisms (Scheuhammer & Norris, 1996). Several countries legislate against the use of lead and Denmark is the leading country with a total ban of lead followed by countries such as Greenland. Sweden has a ban against lead ammunition in wetland areas but lead is still allowed for use in fish sinkers (Naturvårdsverket, fakta om bly, n.d.). As alternatives to lead, sinkers are made of tin, tungsten, glass, iron/steel, brass and zinc. Looking at a large online store for fishing gear in Sweden, lead-sinkers dominated but tungsten sinkers were also found. Some sinkers are named "leadfree", but it is not stated what other material is used instead of lead.

4.4.3 Quantification

In this project it has not been possible to quantify the amounts of harmful substances released from fishing gear in the Nordic countries. Focusing on the plastic materials, it was not possible to collect the information needed about what additives that are used in the production of fishing gear made of plastic. Producers and resellers of fishing gear, contacted in this study could not or were unwilling to share information regarding the chemical content of their products.

This study also looked at collecting data on harmful chemicals in fish gear, from relevant databases. The SCIP database (Substances of concern in products) hosted by ECHA (European chemical agency) contains information about "substances of

concern as such or in complex objects" in concentrations of 0.1% (SCIP- database ECHA, n.d.). However, no fishing related products such as ropes, lines or sinkers could be found in the database. Another database is PRIO (Swedish Chemical Agency, 2022), which is aimed at finding and substituting harmful substances in items. While it is possible to search for specific types of plastic (for example PP) and obtaining a list of products containing PP and its additives, there was no possibility to direct the search towards fishing gear products. In conclusion, it seems as you got to know the substance of concern before you can use the database to get information about the substance and see in what goods it might exist. Moreover, databases like these tend to be too broad and therefor give high uncertainty in the estimates.

5 Proposed measures

An important part of developing and proposing relevant measures is to keep the targeted stakeholder in mind. Depending on the stakeholder, their inherent interest and opportunity to contribute to beneficial impacts will differ significantly. For example, a producer and retailer may be more affected by an economic incentive compared to recreational fishers who may be more interested in the local environment. The main identified issues contributing to loss of fishing gear in the Nordic countries and proposed measures targeting intended stakeholders are presented in Table 18. Some of the proposed measures may be suitable for more than one of the identified issues, contributing to similar efforts being proposed for different issues.

Table 18: A summary of identified issues in connection to lost fishing gear and corresponding measures proposed in this study. The targeted stakeholder is also presented in this table.

Identified issues	Proposed measures	Intended stakeholder
Lack of awareness and knowledge about losses of fishing gear, the environmental impacts and possible mitigation measures	Information signs/plaques at popular fishing sites educating fishers in e.g., local conditions.	Sport and recreational fishers
	Efforts to educating fishers through offering information in well-known apps related to sport and recreational fishing.	Sport and recreational fishers
	Introducing new reporting systems and implement new legislation to make reporting of losses mandatory for all fishers. In case of available applications, information campaigns about the reporting system are proposed.	Sport and recreational fishers, commercial fishers, authorities
Lack of incitements to reuse, recycle or recover fishing gear	SUP-directive and the upcoming EPR scheme for fishing gear.	Authorities, producers, retailers
	Introducing systems for collection, recycling, and reuse with economic incitements and focus on sustainability.	Authorities, producers, retailers
	Developing recyclable fishing gear with focusing on material composition.	Authorities, producers
	Mandatory marking and reporting of lost fishing gear, for example cages.	Sport and recreational fishers, authorities
Lack of easily available statistic on losses of fishing gear	SUP-directive and upcoming EPR scheme for fishing gear.	Authorities
	Updated and more detailed commodity codes connected to fishing gear.	Authorities
	Comprehensive studies focusing on national losses and estimations of lost fishing gear in each of the Nordic countries. In addition, increasing the understanding of lost fishing gear through analysis of materials collected at marine recycling facilities and from cleaning operations.	Authorities
Lack of knowledge and incitements about the presence of harmful substances as well as use of environmentally friendly materials	Product declaration of chemical substances in all fishing gear and banning certain harmful substances in these products, including lead.	Authorities, producers
	Information campaigns about environmentally friendly materials in targeted channels for fishers and producers/retailers.	Commercial, sport and recreational fishers, authorities
Historical losses of fishing gear	Cleaning up historic losses through cleaning operations such as diving efforts. Possible financing through the sale of fishing licenses.	Fishers, authorities

Increased awareness of the problem and the solutions

Losses of fishing gear occurs for various reasons, and multiple measures are most likely needed in order to tackle the problem. When it comes to sport and recreational fishers, informing the fisher about, for example, the environmental impact of ALDGFs and give advice on how to reduce the risk of losing gear, the problem could be addressed directly at its source. Dissemination of information and knowledge of, for example, local conditions as well as national laws and regulations on fishing can be relevant to reduce losses of fishing gear. Local conditions such as the type of lake or seabed, location of fairways, areas with many wrecks or known "hard-to-fish" areas can lead to increased losses. By informing the fishers about these conditions, losses might be reduced. In addition, well fished areas such as those with frequent commercial fishing or fishing tourism, will likely experience greater losses.

Increased awareness and knowledge can be achieved in different ways. One potential measure is to develop informative signs or plaques and place these in certain fishing areas. Relevant hotspots where information plaques may be suitable could be identified by, for example, areas where losses are repeatedly reported through national channels available in each of the Nordic countries. Moreover, it would be possible to identify relevant areas through sharing knowledge with relevant stakeholders through, for example, workshops. The outcomes of these types of informative signs needs to be studied further to establish the impact on losses of fishing gear. However, the potential impact should be discussed compared to the cost of identifying hotspots, developing the literature materials, producing the signs, as well as installing the signs to establish if the effort is worth it, both economically and environmentally. According to the SUP directive, measures to increases the awareness of ALDGFs should be covered by national EPR scheme. Enabling such as informative signs or plaques to be paid for by means from the EPR scheme in each of the Nordic countries.

Another possible way of identifying hotspots is to utilise channels that reaches to many sport and recreational fishers in the Nordic countries. One example of such application is the phone app Fishbrain which has around 14 million users, mainly in the USA and Europe (Fishbrain, n.d.). The application connects sport fishers with each other and uses GPS location to enable users to log their fishing positions. With this tool, several possibilities to locate and reduce lost fishing gear arise. It is an easy way to reach out to key users regarding issues of marine litter and create increased awareness about lost fishing gear. The GPS function opens possibilities to collect data from the users about lost gear, littered areas, fishing hotspot and so on. In an interview[20] with Fishbrain, it was stated that a successful cleaning project had been conducted where members cleaned littered places with help from the app, the commitment had been great among the users. However, there is a need for analysing how and if the data could be utilised by, for example, authorities from a legal perspective. This aspect has not been studied in this project.

In this project it can be discerned that sport and recreational fishers may not have the same possibility or knowledge about reporting systems compared to commercial fishers. Commercial fishers are by Council regulation (EC) No 1224/2009 required to report their losses of fishing gear to the authorities in respective country of origin. Reported losses for 2020 has been found for Sweden, Norway, Denmark, and

20. Chief Marketing Officer at Fishbrain. Online meeting 28th of April 2022.

Iceland has been found in this study. Meanwhile, in Finland, the Faroe Islands and Greenland similar statistics on losses has not been found. Sport and recreational fishers are to be required to register their losses in Norway and Denmark from 2022. In addition, sport and recreational fishers can register their losses in Sweden, Norway, Denmark as well as Finland and Åland. Consequently, some of the Nordic countries could benefit from, and increase their knowledge about losses of fishing gear, by implementing reporting systems for commercial fishermen. Moreover, by making it compulsory for all fishers to report their losses, including sport and recreational as well as commercial fishers, a better knowledge base can be created to support the understanding of the losses. Some important aspects have, however, been identified which limit the outcome from registration systems in the Nordic countries:

- Sport and recreational fishers are often not aware of the possibility of register their losses. By carrying out informative campaigns about available applications the actual reporting of losses may be increased. This could include, for example, advertisement for the applications in suitable channels as well as utilising apps such as FishBrain. Moreover, by informing the public about the environmental impacts of ALDGF the interest in reporting losses may be positively affected.

- The reporting systems only includes certain fishing gear. For example, the Swedish application includes gear such as cages, nets, fishing line and one fraction denoted 'other'. By increasing the number of fishing gear that can be reported, a better understanding of the losses can be obtained from the collected data. Moreover, this would include a wider range of different types of fishing as, for example, sport and recreational fishing that utilities other types of gear than those specified in the applications today.

Norway has to date the best reporting system of all Nordic countries. From 2022 and forward, all fishers are required to register their losses. As their systems have been in place longer than other Nordic countries, there is a general knowledge about them. By sharing the pitfalls and successes recorded in the Nordic countries, especially by the countries that are leading the development, future work with the reporting systems can be supported.

Increase the incitements to reuse, recycle or recover fishing gear

Due to the SUP-directive and the introduction of a EPR scheme, there will be incentives for producers to enable recycling and reuse of their products. Producers must ensure that there are suitable recycling systems for the fishing gear they place on the market. Currently there is a lack of national and regional systems for collecting, reusing and recycling fishing gear. For example, in Sweden the Sotenäs recycling station is the only one that recycle and prepare collected fishing gear for reuse. The capacity to collect, recycle and reuse fishing gear must increase for the fishing industry to become sustainable. To make this happen, the following measures are suggested.

- Increase the ability to recycle fishing gear the composition of materials is a key question. Gear consisting of many joined materials are often difficult to recycle and requires a lot of labor. Introducing and favoring design-for-recycling of new

fishing gear could be more easily recycled. This could be achieved through the national EPR schemes through differentiated fees. By differentiating the fees that a producer must pay for placing a product on the market depending on how well it can be recycled or reused, design for recycling and/or reuse can be rewarded. This would create an economic incentive for producers to develop products that are more circular.

- Increase fishers' incentives for recover, reuse and recycle fishing gear. For example, a system where fishers that hand in their old fishing gear to recycling station are provided with a discount or a coupon on a future purchase or a gift certificate in a relevant store. Similar systems are in place in other industries, such as in clothing industry, where H&M has introduced a system where customers can return clothes in exchange for a gift certificate. This measure would probably make the fishers more eager to find discarded or lost gear, or more interested of handing their own gear to a proper recycling station instead of leaving them in a storehouse or getting rid of them in incorrect ways. However, it requires an economic incentive for the retailers to collect fishing gear.

- Provide grants and funds to initiatives that focuses on reusing, recycling, or recovering fishing gear. Economic initiatives directed to relevant stakeholder, such as non-for-profit organisations, producer, and retailers may contribute to a larger amounts of fishing gear being collected, sorted and eventually reused or recycled. In addition, it would be important to combine this with spreading information about the possibility to recycle fishing gear. If more people know about the possibility of recycling, strategically placed recycling stations or pick up locations will be more widely used.

In order to reduce losses of fishing gear, one potential measure is to require that fishing gear is marked, and losses reported. Benefits with reporting losses have been presented earlier in this report, but it can also help facilitate the recycling and recovery of lost fishing gear. According to Council Regulation (EC) No 1224/2009, commercial fishing gear needs to be marked by all vessels in the EU. In some countries, for example Norway and Sweden, some gear belonging to sport and recreational fishing is required to be marked, such as cages. However, by including more types of gear and introducing requirements for sport and recreational fishers in combination with economic ramifications for fishers when unreported losses are found could be beneficial for reduced losses and increased reporting and recovery of lost gear. This system has been in place in Norway for decades and according to the Directorate of fisheries, this method works well due to the long and ongoing dialogue with fishers.

Make statistic on losses of fishing gear and chemical contents available

One of the main issued identified in this study is the lack of quantitative data on losses within the Nordic countries. A few scientific studies such as Andersson & Eggert (2018), GSAMP (2021), Richardson et al. (2019), Skogesal & Fasting (2022) and Sundt et al. (2018) were found on the subject. Reported losses of fishing gear was only obtained from the authorities in Sweden and Norway (see section 4.2),

however some of the other countries may have access to data that was not readily accessible and thus not obtained in this study. To understand the extent and estimate losses of lost fishing gear, relevant quantitative data and national statistics must be readily available.

Due to the SUP-directive and the EPR scheme the amounts of fishing gear put on the market each year will be registered by all producers in the future. This could provide suitable data for estimating losses of fishing gear, however only fishing gear containing plastic will be applicable. Similar to other products, such as plastic packaging, EPR can contribute to more and detailed data on the amount put on the market. However, there are limitations such as free-riders, producers that does not report their sales even though they are required, which contributes to uncertainties of the data. As all sources of data for estimating the amount put on the market has limitations, the EPR scheme still a viable option for future estimations of lost fishing gear.

Another measure to improve national import, and export statistics on fishing gear is to provide suggestions for new commodity codes. An example of proposals that have previously been submitted to update CN codes, however in another research area, is the project by Boberg et al. (2021). The study proposed new commodity codes for different plastics products. By doing something similar for fishing gear, improved national statistics can potentially be obtained which would facilitate similar estimates of losses as those made in this study. The method used in this study has its pros and cons, but with better statistics, some of the problems could be addressed and more in-depth and more correct estimates could be facilitated.

In this study, rough estimates of losses of fishing gear were based on the responses of the questionnaire of national import, export, and industrial production statistics. Another possible measure is to carry out studies similar as those carried out in Norway connected to their implementation of EPR scheme for fishing gear (Skogesal & Fasting, 2022; Sundt et al., 2018), however with a greater focus on the losses. An in-depth analysis of each country's situation can help to identify local conditions and losses to a greater extent than what has been possible in this project. Another possibility is to increase the understanding of lost fishing gear through analysing materials collected at marine recycling facilities and from, for example, beach cleanings by organisations such as Keep Sweden Tidy. By understanding the material that is collected and recycled as well as the material recovered from nature, a priority of different types of fishing gear as well as more specified measures can be developed.

Increase knowledge and incitements to produce and use environmentally friendly materials

During this project one of the issues that was identified is a lack of information about the content of harmful substances in relevant products. Requiring a product declaration of chemical substances in all fishing gear would provide necessary information for understanding and estimating releases of harmful substances to the environment. The problem with harmful substances originating from fishing gear is complicated and difficult to quantify. In this report, the main focus was connected to plastic and lead. Lost fishing gear made of plastic is a source for microplastic and leaking of plastic additives. Lead enters the aquatic ecosystem when fishers lose, for

example, sinkers. The experience gained from this project is that sport and recreational fishers do not have enough knowledge and awareness of the environmental impact that fishing contributes to. Especially when it comes to the choice of material and how different materials effect the aquatic ecosystems.

Today it is almost impossible to know what type of additives the plastic in fishing gear contains. A way to simplify the regulation of harmful substances is to introduce legislation requiring product declaration of chemical substances for all gear containing plastic. This would contribute to easily available information for consumers which would enable sustainable choice when buying fishing gear. It is also possible for fish-shops to make choices concerning what brands to purchase regarding the table of content. Moreover, by requiring producers to be more open about their materials, the authorities would gain a deeper understanding of the additives that are commonly used in fishing gear.

Considering the problem with softbaits and the number of additives present in many softbait-products, an important measure is to include fishing baits such as softbaits and other baits containing plasticizer in the EU legislation concerning phthalates (see chapter 4.4.1). In this way, import of softbaits containing phthalates can be banned which hopefully can lead to a faster development towards more sustainable softbaits production.

Denmark and Greenland have imposed a ban on lead in various products, including fishing gear. Because of the toxic properties of lead, no apparent reason has been found *not* to ban lead in the rest of the Nordic countries. ECHA Committee for Risk Assessment (RAC) also backs restricting lead in fishing sinkers and lures (ECHA/NR/22/11). However, legislations take time and in the meanwhile increased awareness among sport and recreational fishers as well as commercial fishers could help to reduce the use of lead-based sinkers. This also includes promoting alternative materials that has non or less of an environmental impact compared to lead. Some alternatives, like tin and brass, may not be suitable materials to be used in connection to the aquatic environment. In this report a deeper analysis of suitable materials for replacing lead has not been studied. However, it is considered that there is room for further legislation of lead and marketing of sustainable alternative materials.

Fishbrain cooperates with several brands that sell fishing gear. One opportunity could therefore be to inform brands about the environmental impact of their sportfishing gear and promote brands that are producing more sustainable gear. An observation from this project is that environmental aspects *are not* found when browsing for new fishing gear, instead the argument for selling baits, lines and other gear are related to the fishing experience and how the gear make you catch as much fish as possible. Thus, here is a market with an opportunity to change its selling arguments without losing costumers and turn the sportfishing industry towards sustainability.

Operations to collect historical losses of fishing gear

Efforts to clean hot spots for lost fishing gear might contribute to decreased new losses. Fishing gear stuck at the bottom create obstacles that more fishing gear can get stuck on or entangled in. Old losses contribute to fishers getting stuck increasing the present losses, which has been put forward by at least one Swedish sport fishing

organisation. Campaigns that focus on specific areas known to have large number of losses annually could be an option. The financing for such operations could, for example, be made through sales of fishing licenses. These efforts should be done in a way that data can be collected to follow up on the implemented measures. The cleaning up operations includes, for example, diving efforts and beach clean ups. According to the results from the questionnaire, sport and recreational fishers' fish in lakes, at least in Sweden. This could promote actions to be made in lakes around Sweden. However, as losses appears in all waterbodies, actions to understand and collect historical losses should be considered for both lakes, streams as well as the sea.

The Directorate of fisheries in Norway already partake in annual operations to retrieve as much lost gear as possible (Directorate of Fisheries, 2020). Due to these annual cleaning operations, it is well known in Norway that it is beneficial to register your losses. Otherwise, fishers might get fined if the gear is found later, and they will lose the chance to get it back. According to the Directorate of fisheries, this method works well due to the long and ongoing dialogue with fishers. This could be a relevant measure for other Nordic countries as ramifications for losses may contribute to increased reporting of lost gear. However, this measure would be most efficient in combination with other measures such as legislation requiring all fishers to report their losses as well as marking equipment before use. When combined, a deeper incentive to report, reduce and recover lost fishing gear would be achieved.

6 Uncertainty assessment

Losses of fishing gear presented in this report are often based on deficient background data, thus the estimated losses should only be seen as an indication of the magnitude of the problem. Assumptions made in the report are conservative and based on worst-case scenarios and the precautionary principle. By using two completely different methods with independent data to estimate the losses of fishing gear, the project tried to shed light on the uncertainty of each method. However, even though the methods to some extent give similar results, the figures are overestimated due to our conservative assumptions.

The survey responses were relatively few and mainly from Sweden despite translations into Norwegian, Danish, and Finnish. There were some difficulties reaching out to fishers in other countries and getting responses. Since the survey was voluntary and sent out in channels concerning dedicated fishers, such as sport fishers, it was not possible to avoid statistical bias. The answers from the respondents are likely not representative of losses from all fishers, including both sport and recreational fishers, which was assumed in this study. This assumption most certainly contributes to an overestimation of the losses based on the applied method; however, the extent of the overestimations has not been possible to establish.

Losses based on estimations of the annual amount of fishing gear put on the market are also based on conservative assumptions such as that fishhooks placed on the market largely compensates for previous losses of gear. Old fishing gears are probably stored at fishers' homes and some gears are safely thrown in the bin or turned in for recycling, but these quantities were not estimate in this study. By openly presenting assumptions and how we have calculated there are however opportunities to do scenarios to see what the losses would be if, for example, 50% of the fishing baits put on the market are lost instead of 100%.

There are inherent issues and limitations with estimating the amount of fishing gear put on the market based on imports, exports, and industrial production. First of all, the CN codes and PRODCOM codes are unspecific, and it is not clearly stated which products or goods are included or not. Moreover, the different sources of data do not completely overlap, meaning that goods included in CN codes does not always correspond to the exact same goods in a PRODCOM code. The statistics also depends on goods being rightfully reported by importers, exporters, and producers to the authorities. There is a source of error in the statistics as goods may be reported wrongfully, thus including products that are not fishing gear.

For the national statistics studied in this project, it has also not been possible to separate products used in commercial fishing from sport and recreational fishing, which also leads to an overestimation of losses. For example, CN code *560811 - Fishnets, made up of man-made fibres*, does not specify if the nets are used for other products such as trawls, cages, or pots. As all different types of fishing gear made from fishing nets can be assumed to be included in this CN code, the amount put on the market specifically for commercial fishing compared to recreational

fishing has not been possible. Total amounts put on the market as well as estimating the losses are assumed to include all fishing activities. There are big differences in amount of material lost depending on type of gear, such as the difference between a commercial trawl and a recreational fishers cage. The assumption of losses will thus affect the estimated losses, which the reader should be aware of.

7 Discussion and conclusions

This study has focused on estimating the amount of lost fishing gear in the Nordic countries, including Sweden, Norway, Denmark, Finland and Åland, Iceland, the Faroe Islands and Greenland. In addition, the content of harmful substances in fishing gear and its potential impact on the environment has been discussed. Based on this, measures have also been proposed to reduce the amount of lost fishing gear in the Nordic countries and how it is possible to prevent leakage of harmful substances. Depending on whether the losses are calculated, either on the basis of the survey developed in this study or whether it was calculated through national statistics, it amounts to the following:

- Based on the survey, approximately 280 tonnes of baits, 140 million metres of fishing line and 11.2 million sinkers are lost by the Nordic countries each year.
- Based on national import, export and industrial production statistics, approximately 775 tonnes of fishhooks, 78 million to 235 million metres of fishing line and 520 to 1 040 tonnes of gear containing fishing nets are lost by the Nordic countries each year.

These losses are based on assumptions and simplifications resulting in uncertainties and sources of error in the result. Therefore, the result can only be used as an initial attempt to quantify the extent of ALDGFs in the Nordic countries. Further studies are required to obtain more specific data and quantification of the losses in the Nordic region. When it comes to harmful substances, plastics and lead have been identified as important in the discussion about reduced leakage of harmful substances into nature. For plastics, it is mainly additives with a known impact on nature such as phthalates that are harmful while lead is already known to be harmful. In this study it has not been possible to quantify the leakage of harmful substances based on the estimated losses. This is largely due to a lack of information on the content of harmful substances in plastics used in fishing gear. In order to enable such an estimate to be carried out, data from producers is required. However, no such incentives are in place to provide companies with reasons to share the relevant information.

In this study the main focus has been on sport and recreational fishing, thus commercial fishing is included and deliberated upon to a lesser extent. The reasoning behind this focus is the lack of quantitative data for losses originating from sport and recreational fishing. Commercial fishing vessels are required to report their losses of gear to the authorities according to Council Regulation (EC) No 1224/2009. Consequently, quantitative data is in theory more widely available for commercial fishing. However, the difficulties in collecting relevant data arose in this study. In some cases, the relevant authorities sitting on the information could not be identified and in others the information could not be obtained from the authority. In addition, the fishing gear within the scope of this mainly focus gear utilised recreational fishing. However, some overlap of gear between recreational fishing and commercial fishing is found, for instance, pots and cages. Estimations of the losses were not able to be divided depending on different fishers and in some cases other

fishing gear not included within the scope was covered by the estimations. One such example is the estimation of 520 to 1 040 tonnes gear containing fishing nets based on national statistics. To enable an approximation to be made an extension of scope was required in this individual case.

The survey developed in this project was aimed at sport and recreational fishermen. It was intended to provide data on losses for actual practitioners in the Nordic countries as no such data could found for the target group. No previous studies have been found where similar questions have been asked to fishermen in the Nordic countries or internationally. The questionnaire allowed rough estimates of baits, fishing line and sinkers to be made. However, the shortcomings of these approximations should be taken into account when the figures are further used. First of all, only 449 responses were obtained, which statistically should not be seen as a sufficiently large number of data points to be representative to a greater extent. Of the respondents, the majority of the responses were from Swedish sport and recreational fishermen, which thus mainly reflects the Swedish conditions. One lesson from sending out the questionnaire is that sport fishers can be easier to reach out to as they are more organized than recreational fishermen are. In addition, in some contexts it is difficult to reach out to this target group as it can be considered a sensitive topic to discuss, and organizations and groups can refrain to answer questions as they do not consider themselves a part of the problem. As a conclusion, even with the shortcomings and lessons learned in this study, there are currently no other statistics available. In future studies, a broader set of questions, for example including more types of fishing gear, and wider attempts to reach out to a larger number of respondents in the Nordic countries may contribute to making estimates that are more specific to each country.

National statistics on imports, exports and industrial production were used to approximate fishing gear. This method has several shortcomings as the CN codes are not specific enough to calculate the losses of all types of fishing gear included in this study. Especially the industrial production is problematic as the data originates from PRODCOM which bases its data on information from producers. It is voluntary to provide data to PRODCOM and they do not publish data based on only one consulted stakeholder, thus contributing to lack of available data that is needed for this methodology. Translating PRODCOM codes into commodity codes also contributes to a source of error as these do not fully overlap with each other. Ultimately, the approach requires the use of many crude assumptions to approximate losses of fishing gear from the rough estimates of gear put on the market. Several options exist to address these problems; however, they are often time-consuming and require new legislations and, in some cases, investments are needed. For example, the development of new and more specific commodity codes. Today, there is no other national statistics available of the amount of fishing gear put on the market except those calculated similarly to the methods used in this study. In the future, the EPR for fishing gear will be able to contribute important data for further estimates of losses in the Nordic countries.

In the study, several issues have been identified. This includes a lack of knowledge about the extent of the losses and the content of harmful substances in fishing gear. These issues are widely studied, and efforts are made to deal with them within most Nordic countries. However, there are signs that sport and recreational fishers do not have the same knowledge or gained the same influence in the problem of ALDGFs.

In addition, the lack of incentives to recover, recycle and reuse fishing gear contributes to fishing gear not being taken care of sustainably. By improving the conditions for handling end-of-life gear and by managing historical losses it can help to counteract new losses. The measures proposed are intended to reflect the problems identified in the study. In several cases, similar measures can help to deal with several problems and sometimes combinations can be beneficial. However, the study has not carried out an analysis to investigate whether the measures are feasible in practice or whether they are, for example, too time-consuming or costly. Ultimately, further studies are therefore required to determine which measures should be adopted in the Nordic countries.

The continued work on ALDFGs by the Nordic countries should include dialogues where all stakeholders are present. An important aspect is to ensure that all stakeholders understand the problem and their part in the losses of fishing gear today. In addition, they need to be informed on how they can contribute to a positive change towards sustainable fishing in the Nordic countries. Without a common understanding of these aspect a collective responsibility cannot be achieved. It is important to include sport and recreational fishers in order to reach all of those directly contributing to the losses. Further research studies are one of the measures proposed to be important for the future. In addition, it is possible to discern that workshops, stakeholder collaborations and informative campaigns can contribute with important knowledge and dissemination of already obtained knowledge. In conclusion, there are many suitable approaches to deal with the problems of ALDFGs, however, that further work is required as has been established in this study.

It can be concluded that some of the Nordic countries are more progressive in their work with losses of fishing gear. For example, Norway has introduced various measures to reduce the losses by requiring fishers to report their losses, partaking in clean-up operations as well as introducing reporting systems for both commercial, sport and recreational fishing. Sharing knowledge of successful approaches as well as working together towards more sustainable fisheries are needed as the problem is often shared. International work conducted by, for example, the Nordic council of ministers and Helcom is needed to gain better knowledge about the issue of lost fishing gear. This pilot-project is one of the actions towards understanding the situation in the Nordic countries.

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Appendix I

Table AI:1. List of organisations in the Nordic countries identified to be relevant for commercial-, sport- and recreational fishing well as organisation linked to recovery, reuse, or recycling of fishing gear. The organisations that were contacted in this study are marked with an X.

Country	Organisation	Contacted
Sweden	Swedish Agency for Marine and Water Management (Havs- och vattenmyndigheten)	X
	Swedish Environmental Protection Agency (Naturvårdsverket)	X
	Swedish Board of Agriculture (Jordbruksverket)	X
	Swedish Fishers' Producer Organisation (Sveriges fiskares producentorganisation, SFPO)	
	Swedish Sport Fishing and Fishing Conservation Association (Sveriges sport fiske – och fiskevårdsförbund)	X
	Swedish Sport Fishing Trade (Svensk Sportfiskehandel)	X
	WWF Sweden	X
	National Association of the Fish Industry (Fiskebranchens Riksförbund)	X
	Sweden's Fishing Tourism Entrepreneurs (Sveriges Fisketurismföretagare)	X
	Keep Sweden Tidy (Håll Sverige rent)	X
	FF Norden	X
	Marine recycling facility in Sotenäs	X
	Swedish Chemicals Agency (KEMI)	X
	RISE Research Institutes of Sweden	X
Norway	Directorate of Fisheries (Fiskeridirektoratet)	X
	Institute of Marine Research (Havforskningsinstituttet)	X
	Norwegian Hunter and Fishers' Association (Norges Jeger- og Fiskerforbund, NJFF)	X
	Keep Norway tidy (Hold Norge Rent)	X
	Mepex Consults AS	X
	Egersund Group Fishery	
	Skagerak Tråll og Notbøteri A/S	
	Åkrehamn Trålbøteri AS	
	Mørenot Fishery AS	
	Selstad AS	
	Westmarin AS	
	Norwegian Sports Industry Association (Norsk Sportsbransjeforening)	
Denmark	Board of Fisheries Denmark(Fiskeristyrelsen)	X
	National Institute of Aquatic Resources (Institut for Akvatiske Ressourcer - DTU Aqua)	X
	Danish Sport Fishing Federation (Danmarks Sportfiskeforbund)	X

	Ministry of Environment of Denmark (Miljøministeriet)	X
	Havmiljøvogter	X
Greenland	Department of Greenland (Naalakkersuisut)	X
	Greenland Fly Fishibg	X
	KNAPK, Fishermen and Hunters Association in Greenland	X
	Angling Club Lax-a	X
Finland and Åland	Finnish Association of Professional Fishers	X
	Finnish Environment Institute	X
	The Federation of Finnish Fisheries Associations	X
	Finnish Federation of Recreational Fishers (Finlands Fritidsfiskares Centralförbund)	X
	Segling och båtsport i Finland	X
	Fishers of Åland (Ålands fiskare)	X
	Fisheries Agency Åland (Fiskeribyrån)	X
Iceland	Ministry of Food, Agriculture and Fisheries	
	Ministry for the Environment and Natural Resources	
	Marine and Freshwater Research Institute	X
	University of Iceland´s Research Centre in Sudurnes	X
International	Nordic Council of Ministers	X
	Carapax	X
	Happy Angler	X
	Darts	X
	Svartzonkers Sweden	X
	Pure fishing	X
	Swedsen sport	X
	Decathlon	X
	Biltema	X
	Bauhaus	X
	Jula	X
	XXL	X
	Fishbrain	X
	Vision and Wastin	
	Patagonia	
	LOOP	
	Daiwa	X
	Rapala	X
	Shimano	X

European Fishing Tackle Trade Association (EFTTA)	
OSPAR	
Fladen fishing	X
Helcom	

Appendix II

The questionnaire was translated into Swedish, Norwegian, Danish and Finish. Some minor differences in the questions asked might be found due to faults in the translation.

Questions in Swedish

- Hur många dagar per år fiskar du?
- Vilket typ av fiske ägnar du dig åt?
- Vilket typ av vatten fiskar du mestadels i?
- Hur många burar (tinor, ryssjor, mjärdar) förlorar du per år?
- Hur många nät förlorar du per år?
- Hur många sänken förlorar du per år?
- Hur många meter lina förlorar du per år?
- Hur många drag förlorar du per år?
- Vilken typ av drag blir du främst av med?

Questions in Norwegian

- Hva slags fiske driver du med?
- Hva slags vann fisker du mest i?
- Hvor mange dager fisker du per år?
- Hvor mange bur (teiner, merder, ruser) mister du per år?
- Hvor mange fiskegarn mister du per år?
- Hvor mange sluker mister du per år?
- Hvor mange meter fiskeline mister du per år?
- Hvor mange søkker mister du per år?
- Hvilken type sluk mister du oftest?

Questions in Danish

- Hvilken type fiskeri dyrker du?
- Hvor mange dage fisker du pr. år?
- Hvor mange lod mister du pr. år?
- Hvor mange meter line mister du pr. år?
- Hvor mange stykker endegrej mister du pr. år?
- Hvilken type endegrej mister du typisk?
- Hvor mange burer (ruser eller tejner) mister du pr. år?
- Hvor mange net mister du pr. år?

Questions in Finish

- Millaista kalastusta harrastat?
- Miten monena päivänä kalastat vuodessa?
- Miten monta painoa menetät yhden vuoden aikana?
- Miten monta metriä siimaa menetät yhden vuoden aikana?
- Miten monta viehettä menetät yhden vuoden aikana?
- Millaisia vieheitä menetät eniten?
- Miten monta pyydystä (katiskaa, mertaa, rysää) menetät yhden vuoden aikana?
- Miten monta kalaverkkoa menetät yhden vuoden aikana?

Appendix III

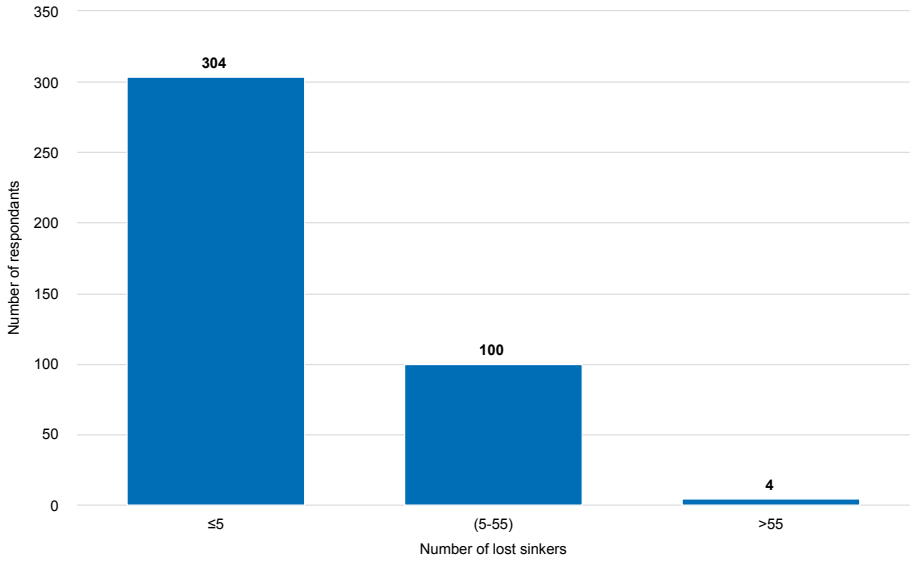

Figure AIII:1
Answers from the questionnaire on the number of lost sinkers yearly.

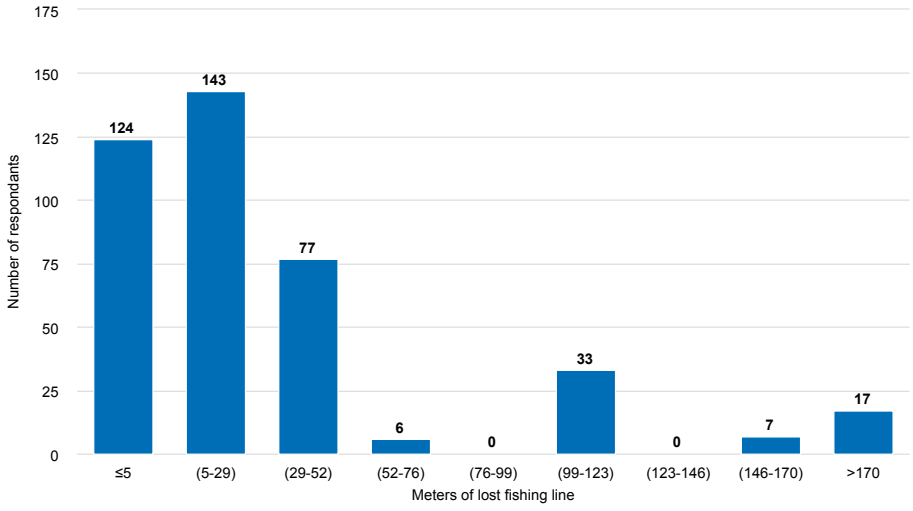

Figure AIII:2
Answers from the questionnaire on the amount of lost fishing line (m) yearly.

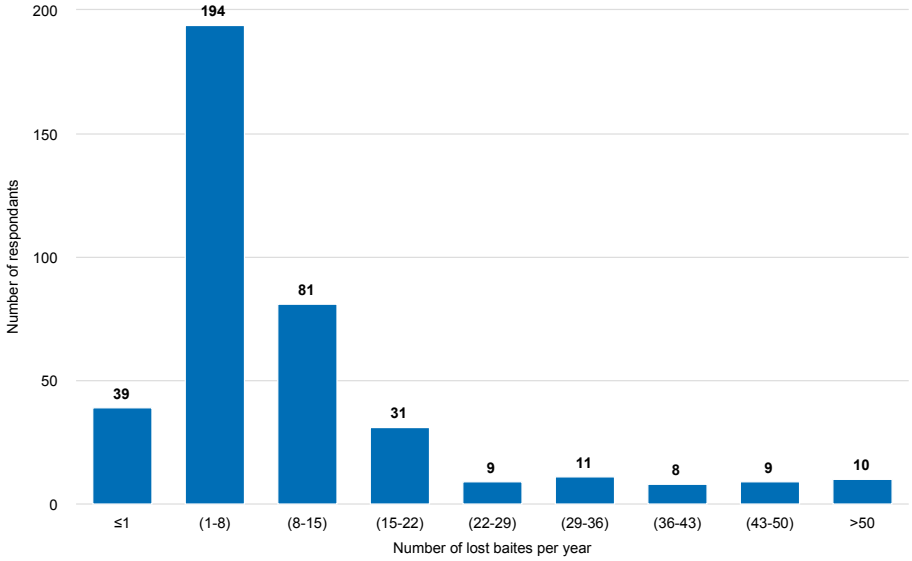

Figure AIII:3
Answers from the questionnaire on the number of lost baits yearly.

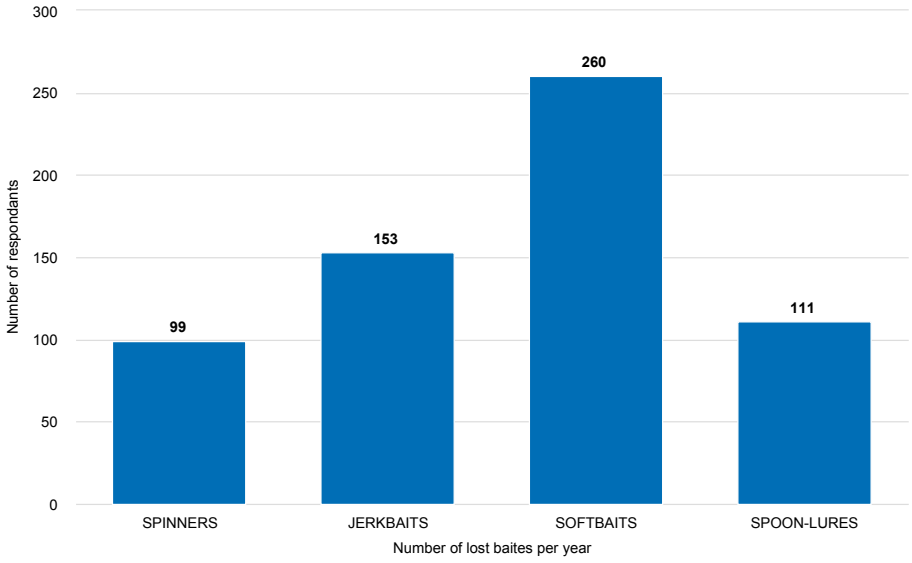

Figure AIII:4
Answers from the questionnaire on what kind of bait you mostly lose yearly.

About this publication

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